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SMOKE RINGS

Our Cover Picture

● THIS PHOTOGRAPH, together with that reproduced on the next page, has been submitted to us by Mr. W. H. Foster, of Bingley, Yorks. It represents an unusual and interesting model which has recently been completed by Mr. Eric Thornton, of Bradford, whose model engineering activities are devoted mainly to reproducing, in miniature, tramcars, both old and new.

Breaking away from the actual tramway car, Mr. Thornton has, with very limited details available, constructed an excellent, non-working scale model of the first "Trackless Tramcar" to be placed in regular service in Britain.

This forerunner of the modern trolley 'bus was built in 1911 for Bradford Corporation, by the Railless Electric Traction Co. Ltd., the 29-seater body being supplied by Messrs. Hurst, Nelson & Co. Ltd., of Motherwell.

Two "Bull" direct-current traction motors provided the power, which was transmitted to the rear wheels through worm gears and chain drive, the housings of which can be seen clearly in the photographs of the model. A then new type patented double-trolley gear, supplied and manufactured by Railless Electric Traction Co. Ltd., is also faithfully reproduced in the model.

Speed was regulated by a tramcar-type controller, mounted in the cab alongside the steering column, the top speed being a little over 12 m.p.h.

When Mr. Thornton decided to construct his model, no drawings were available, only three photographs showing side, front and rear views of the vehicle. From these photographs Mr. Thornton prepared his own drawings, using a slide rule, working to a scale of 4/10 in. to 1 ft. from the only known dimension; this being the size of the numerals painted on the car side.

Since the model was completed, original drawings have come to light, which show that only a very slight error in the dimensions of the model was made, namely, ⅛ in. on wheelbase. This model is to be placed on public view in the Cartwright Memorial Hall, Lister Park, Bradford.

Building a Locomotive in Ten Days

● AT THE "M.E." Exhibition, the Malden and District Society of Model Engineers will have a stand comprising a workshop equipped with all the basic tools required for building a model locomotive right from the start. Moreover, the members who have been selected to man the shop have set themselves the task of building a "Maid of Kent" 5-in. gauge 4-4-0 engine in the ten days during which the exhibition will be open.

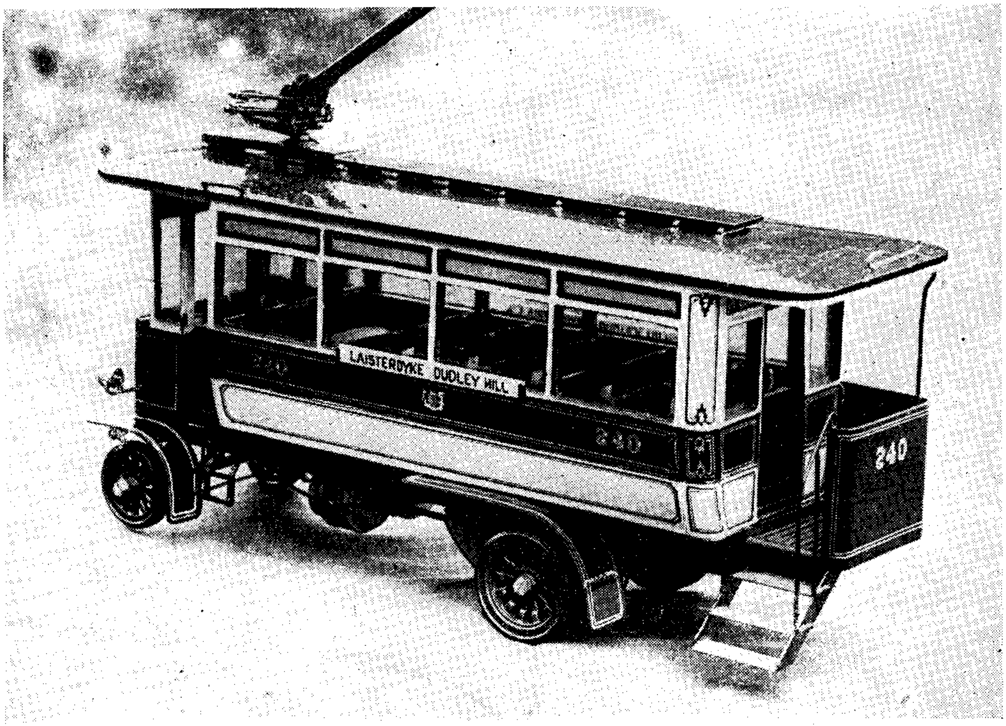
This will *not* involve merely the assembly of machined castings and finished parts, but is to include every process required from the machining of the wheels and the marking-out of the frame plates to tightening up the last nut on the finished engine!

It is an ambitious programme and one which will require most careful planning and a full quota of the " team spirit " which is so prominent in the Malden Society.

except the floor, was easily possible without being thrown off one's balance.

The train achieved a literally non-stop trip, and for practically the entire distance was running two or three minutes ahead of time. It was made up of sixteen coaches having a tare of 506 tons and a gross weight of 520 tons. With this load, the locomotive accelerated from the start to 50 m.p.h. and held this speed up the Camden bank. Both Shap and Beattock banks were climbed at a steadily-sustained 52 m.p.h., novel experiences, indeed, up these two formidable inclines. At only one place in the entire journey was the speed allowed to exceed 70 m.p.h. This occurred at Blisworth where, for a brief moment, 75 m.p.h. was registered on the tachometer.

Perhaps the most striking of the locomotive's capabilities, however, was the extraordinary rapidity of its acceleration after checks; and there were quite a few checks due to permanent-way work in progress. Time lost in this way was invariably recovered quickly, and the stop at the end of the 401¾-mile trip was made two minutes ahead of schedule. The overall time for the " Royal Scot's " run has now been cut by 25 minutes, but this gave not the slightest trouble to the twin diesel-electric unit; and we do not suppose it will bother the 4-6-2 steam locomotives which will normally work the turn.



A rear end view of Mr. E. Thornton's model " Trackless Tramcar "

Britain's First Diesel Express Locomotive at Work

● JUNE 1ST, 1949, was something of a landmark in the history of railway locomotion in Britain; for on that day, the " Royal Scot " was hauled for the first time, from Euston to Glasgow non-stop, by the 3,200 h.p. twin diesel-electric unit. We had the privilege of travelling on the train on this momentous occasion, and, at one part of the journey, we were allowed to pass through to the locomotive for the purpose of watching it in operation. It was all very interesting, a novel, if somewhat noisy, experience; but in the driver's cab we found conditions more nearly comparable with the comfort and comparative quiet of a passenger coach, while the view of the road ahead was, of course, superb.

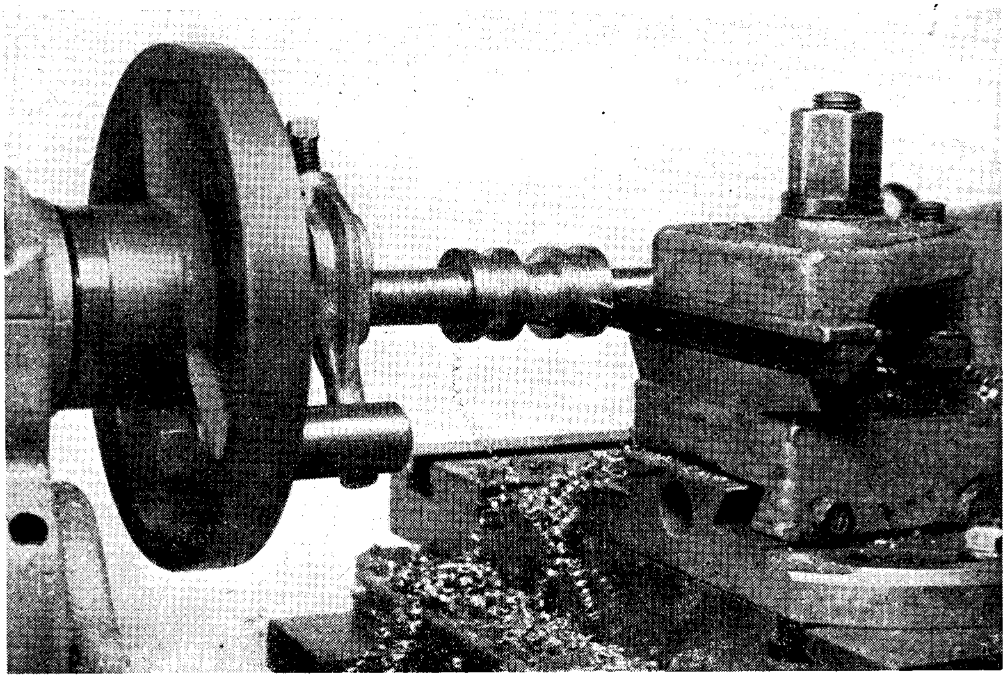
The locomotive, each portion of which is mounted on two six-wheeled bogies, rides very well indeed, and we found that standing with one's arms folded, and with no other support

PETROL ENGINE TOPICS

*A Twin-Cylinder 2.5 c.c. Compression-Ignition Engine

by Edgar T. Westbury

ANOTHER very important item in the working parts of the engine is the crankshaft, which should be machined from the solid, and preferably from high-tensile steel. While I am not prepared to say that a fabricated shaft may not be entirely satisfactory, I have no experience in the use of such shafts in small c.i. engines, and the very high maximum stresses on the crank-



Roughing out the crankshaft

shafts of such engines would undoubtedly find out the weak spots in their structure very quickly. For the same reason, the material used for the shaft is equally important; mild-steel is adequate from the structural aspect, but is liable to wear badly unless case-hardened, which is difficult to carry out without risk of serious distortion. In the prototype engine, I have used a high-tensile alloy steel of a type specially suited to high-duty crankshafts, and so far it has proved entirely satisfactory. While this steel is a good deal more difficult to machine than "free-cutting" mild-steel, it does not necessarily call for the use of special tool steel; carbon- or silver-steel tools will stand up quite well if properly tempered and the work is not run too fast.

Methods of Machining

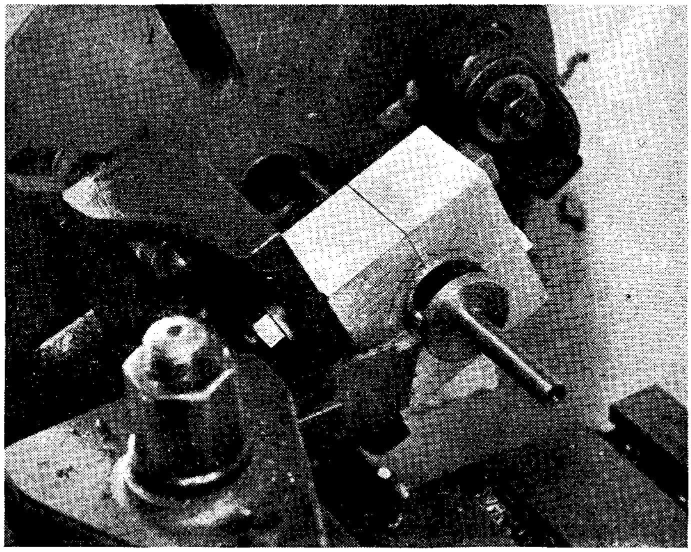
The orthodox method of turning the crankshaft on throw centres is not very satisfactory in the case of this shaft, especially if high-tensile steel is used. I tried this method on my first attempt to make the shaft, and all went well until the first crankpin was machined, after which the shaft was so weakened that despite the usual precaution of fitting a stiffening-piece in the gap between the webs, it failed to stand the strain of turning the second crankpin, and bent like the proverbial dog's hind leg. It was sadly consigned to the scrap heap and another shaft machined by a more suitable method.

I have on several occasions referred to the machining of overhung cranks by the use of simple eccentric chucking fixtures, but it is not commonly realised that the same methods can be applied to multi-throw cranks. As a matter of

*Continued from page 11, "M.E.," July 7, 1949.

fact, however, they have entirely superseded turning between centres in the quantity production of crankshafts for full-size engines, special crankshaft lathes being used, in which devices for holding the shaft close up to the web of the crankpin to be turned, and with means of adjusting the amount of offset, are the salient features of the design.

In the case of this crankshaft, our old friend the Keats angle plate may be used, and the machining dealt with as for two separate overhung shafts, by holding each of the main journals in turn in the vee-block, with the shaft offset and suitably indexed to bring each crankpin in turn to the required position. If desired, it is quite practicable to use, in addition, throw centres on the ends of the shaft for supporting it by the back centre ; but it may prove somewhat difficult in practice to set the work up so that the centres run dead truly, and if this condition is not observed, they are quite useless.



Turning one of the crankpins

The method actually used is illustrated by the photographs, and while similar in principle to that in which the main journals are clamped in an eccentric fixture, it provides improved rigidity by holding the shaft over the outside of the circular webs, and closer to the crankpin than is possible by any other method.

The material for the crankshaft, having been faced and centred on the ends, is turned between centres to exactly $\frac{7}{8}$ in. diameter on the outside, and dead parallel, the latter condition being most vitally important. All three of the journals may be finished right out at this setting, and shallow grooves turned as " witnesses " to indicate the positions of the crankpins.

Making the Fixture

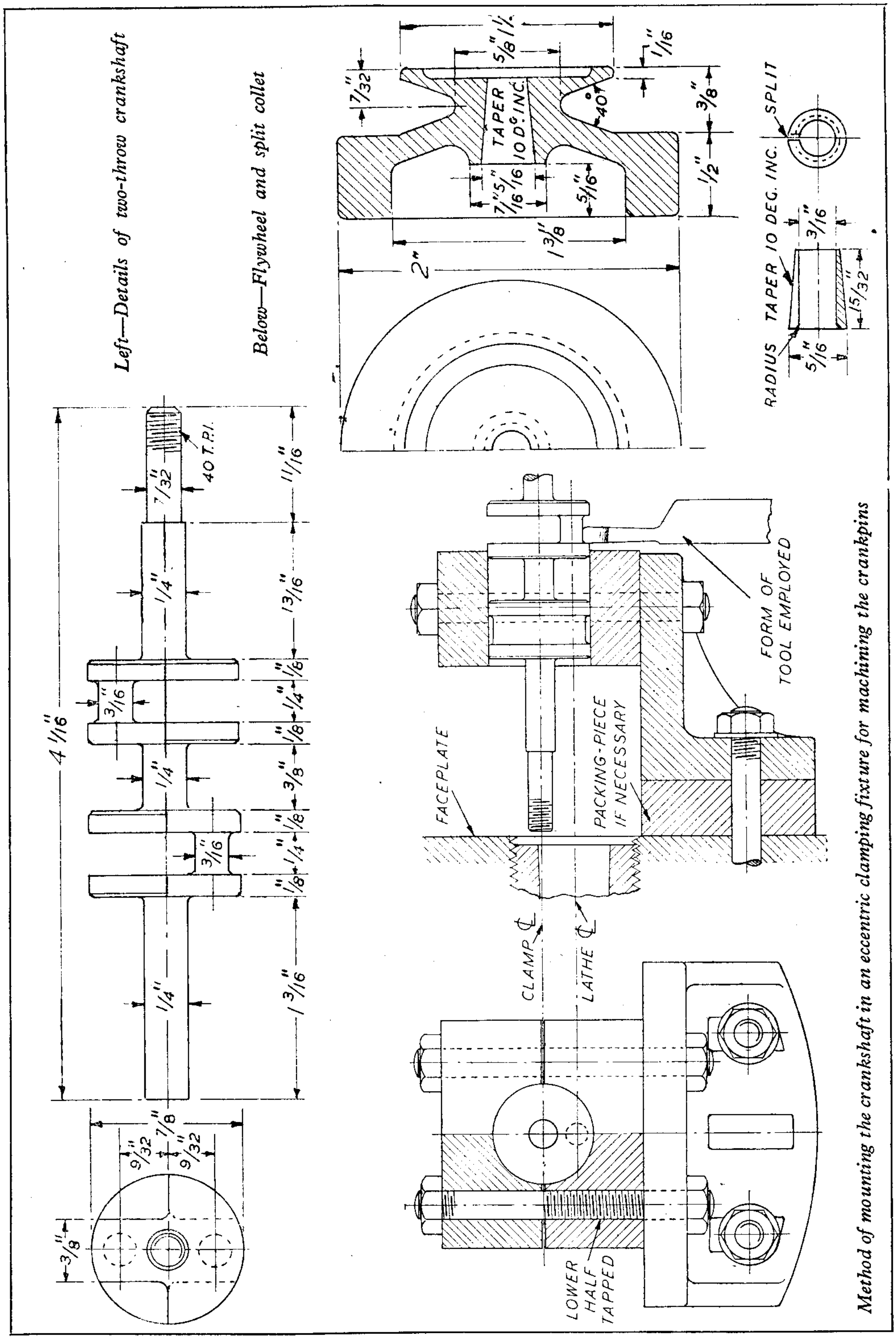
A clamping fixture is now made to mount on an angle plate, in the form of a split " plummer block," which in my case was made from a scrap piece of duralumin, though almost any good material, stock bar or cast stuff, could be used. The halves of the clamp are $\frac{7}{8}$ in. by 1 in. by 2 in. long, and should be true on the bolting faces ; holes for the clamp-bolts are drilled $1\frac{1}{4}$ in. apart, the holes in the lower half being tapped so that it may be held firmly to the angle plate when the clamp is slackened. All these dimensions may have to be modified to suit the material available, also the distance apart of the slots in the angle plate used, but the depth of the clamp from front to back should not be less than $\frac{15}{16}$ in. so that it will bear on three of the crank webs at once when in use.

The angle plate, if not sufficiently deep to carry the clamp in such a position that the longest end of the shaft will clear the faceplate (see diagram), must be spaced out from the latter by a parallel packing block, as shown. Before boring the clamp, the lower half is secured to the angle plate, square with the lathe axis, by means of $\frac{1}{4}$-in. studding, or bolts having threads practically their entire length. The top half is then attached, with cardboard or metal shims interposed between the halves. A facing cut may be taken over the front face, which must, of course, project slightly proud of the edge of the angle plate, after which a line is scribed square across the centre of the clamp, as sharply and distinctly as possible. The angle plate is then moved to set the intersection of this line with the joint between the halves to run dead truly, and the clamp bored out to a push fit for the crank discs.

Offsetting

Next, the entire angle plate and clamp assembly is set over 9/32 in. from the centre position. There are several ways of measuring the amount of offset, the simplest in this case, where super-accuracy is not called for, being to use a setting-piece, consisting of a short piece of $\frac{7}{8}$ in. material with a $\frac{9}{16}$ in. diameter circle scribed on its face. A centre-punch mark is made on this circle, and after inserting the piece in the clamp, and securing it in position (the shims between the halves are, of course, removed) this dot is used to locate the exact centre in the offset position. The assembly may be shifted in any direction but it is best to shift it *towards* the faceplate centre, as this not only reduces the overhang and possible spring, but also the moment of unbalanced weight, which must, of course, be counteracted by weights attached on the opposite side of the faceplate.

Before inserting the crankshaft in the clamp, it should be carefully marked out with a centre-line running across all the discs, and the faces of the outer disc on each side. Use a sharp scriber, and avoid false lines ; it is advisable to put a



Left—Details of two-throw crankshaft

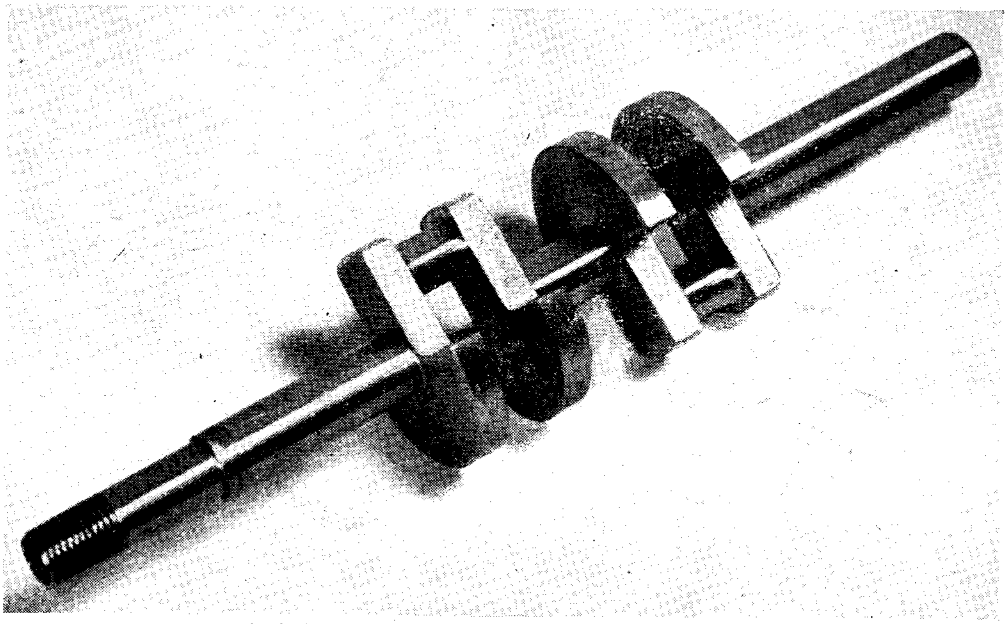
Below—Flywheel and split collet

Method of mounting the crankshaft in an eccentric clamping fixture for machining the crankpins

light centre dot on the line on opposite sides of the end discs, to indicate where the crankpins are located, thus avoiding the risk of machining them both in the same plane, instead of in opposition.

The shaft is now inserted in the clamp, as shown in the drawing, and the centre-line on the web carefully lined up with the cross line on the clamp, using a watchmaker's lens to locate its exact position before tightening the clamp. With reasonable care, it is possible to obtain very accurate angular location in this way, but a very slight error is not likely to have serious results, as it affects only the relative timing of the two cylinders, which are really self-contained engines, and not dependent on each other in this respect.

The form of tool recommended for turning the crankpins is shown in the drawing, and it is virtually a parting tool $\frac{1}{8}$ in. wide, with the front edge ground square and radiused at the corners. It should have plenty of top rake and be kept oilstoned to a keen edge. Do not attempt to plunge-cut the crankpins but put on only a few thousandths of cross feed at a time and traverse the tool sideways between limits, as shown on the topslide index. The lathe should be run at its slowest direct speed, and plenty of lubricant—soluble compound or thinned cutting-oil—applied by brush or drip can. It is, of course, necessary to use a tool having sufficient length in the narrow portion to reach to the full depth of the web, but I have found a solid tool, having a substantial shank, preferable to one having an inserted cutter blade, owing to its improved sideways rigidity. The tool should be well backed off all ways behind the cutting edge, so that it can be used to face the sides of the webs. It is not possible to measure the crankpin with a micrometer, but one should be able to work to within one or two "thou." with calipers, using a standard $\frac{3}{16}$-in. rod for checking, and final accuracy may be obtained by means of a narrow ring lap, which should be kept moving sideways when in use. A ring lap is also advised for finishing the main journals to correct size and high finish.



The finished crankshaft for the "Ladybird" engine

Some readers may prefer to reduce the amount of machining work on the crankpins by sawing and drilling away the bulk of the metal between the webs. This is a matter for individual preference, but in the case of a very small engine, I have found that it takes just as long as machining the material right out in the lathe.

The webs may be cut away by using a small circular saw in the lathe, in conjunction with a simple indexing fixture to hold the shaft. Before setting up for this operation, however, the webs must be carefully marked out, and two 3/32-in. holes drilled from each end, through two of the webs in each case, to form fillets in the corners of the cutaway portions. Two cuts may be run straight through all four webs on the centre-line, at right angles to the crankpins, the shaft then being indexed through 90 deg. and offset $\frac{3}{16}$ in. each side of the centre for the cuts on each side of the crankpin, which, of course, are only taken through two webs on opposite throws, and a saw not larger than about $1\frac{1}{4}$ in. diameter must be used to avoid cutting into adjacent webs.

Alternatively, this operation may be carried out by hand sawing and filing, a tool such as the Eclipse 4s, to hold short stub saw blades, being useful for this work; or it may be done by an

end-milling process. In all cases, care must be taken in holding the shaft, so that it is not strained or distorted.

The thread on the end of the shaft should preferably be screwcut, but the use of a tailstock die-holder is permissible if the shaft is chucked truly and other reasonable precautions taken to ensure a true thread. In the absence of a 7/32 in. × 40 t.p.i. die, other standard fine threads are permissible, but Whitworth thread is undesirably coarse. The nearest B.A. thread is No. 1.

Flywheel

The method of securing the flywheel is by means of a split taper collet, such as I have used with success on several of my engines. The advantages of this method is that it gives an adequate friction surface and avoids weakening the shaft such as would be caused by turning a taper on the end of the latter from the journal diameter downwards, involving also a much smaller thread diameter at the end.

A cast-iron blank is available for the flywheel, but steel or brass is also suitable. It should first be mounted in the chuck and the outer end roughed out, also as much of the outer diameter as is accessible; then reversed for facing and recessing the back, centre drilling and boring to a 10 deg. taper as shown. A tapered mandrel is then made to mount the flywheel for finishing the turning of the outside and ensuring that all parts of it run quite truly.

The collet is made of steel, and the taper should be very carefully fitted to the bore of the flywheel by methods which I have several times described for previous engines. It should be concentrically drilled to a tight push fit on the shaft, and may be slit with a circular saw before parting off. To face and radius the large-end, it may be pushed on a slightly oversize 7/32-in. mandrel. When fitted to the flywheel, the small-end should come to within about 1/32 in. of the front face of the latter, so that the shaft nut will draw it up tightly without fouling the end.

(To be continued)

Chemical Silver Plating

by S. A. Stead, B.Sc. (South Australia)

A CHEMICAL process for depositing silver was mentioned in an article, "Time from the Mains" (THE MODEL ENGINEER, December 2nd, 1948). In case any readers wish to try out the process, here are a few details. It should be remembered, however, that the method does not produce as thick a layer as the orthodox electrical process, nor is the deposit as wear-resistant. When covered with a clear lacquer, it is reasonably serviceable. The chemical reaction involved is known as displacement, i.e. as the silver is deposited it is replaced in the solution by some of the base metal, which, when completely covered with silver, no longer reacts with the solution, hence the extremely thin deposit.

In preparing the plating solution, a small quantity of silver nitrate is dissolved in water, preferably distilled, but not necessarily so. The writer uses about as much as will rest on a threepenny-piece (about 1/20 oz.), dissolved in two or three ounces of water. To this is added a solution of common salt, say a teaspoonful in an ounce or two of water. Silver chloride is formed as a white sediment, which will soon settle out completely, when the clear liquid can be poured off carefully and discarded. It is desirable to wash the silver chloride several times with water, by stirring, allowing to settle and pouring off the water. The silver chloride is dissolved in water; quantities are not critical, but ½ oz. dissolved in three or four ounces of water gives satisfactory results. Such a solution is sufficient to do a surprising area of plating. However, a fresh solution appears to produce better results and, as the silver nitrate is expensive, it is well not to make up a large quantity at a time.

The brass or steel to be plated is polished, dipped momentarily into nitric acid in the case of brass, or in caustic soda in the case of steel, and immediately washed in running water. Before drying, it is tranferred to the plating solution, without being touched by the hands. A silver film begins to form immediately. In a short time the base metal is covered and no further deposition takes place; it is as well to remove and wash and dry the article at this stage, as prolonged contact with the plating solution seems to discolour the work. The silver can then be polished by rubbing briskly with a soft cloth. Incidentally, large surfaces can be coated by rubbing the surface with a cloth soaked in the plating solution.

As the layer of silver is so thin, it will not resist the abrasive action of metal polishes and it is advisable to protect it against tarnishing by means of a coat of clear lacquer, made by dissolving a few scraps of celluloid in a mixture of equal parts of acetone and amyl acetate. This lacquer, applied by brushing, dipping or spraying, will also serve to protect any metal against tarnishing.

A Lathe-Made Challenge Cup

by R. Johnston

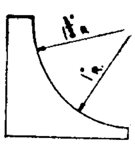
THE Challenge Cup shown in the photograph was the result of some experimental work undertaken on the lathe.

The cup is made of brass, chromium plated, and excluding the base, is in two parts, the break occurring at the top of the stem, just underneath the bowl.

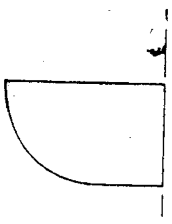
In the initial stages, patterns were made for the cup, two being roughly turned up in wood. Work commenced on the bowl or top part first, and I was fortunate indeed in having the use of a friend's 5-in. lathe, on which the whole of the work was carried out.

Note how the lip is thinned out towards the edge

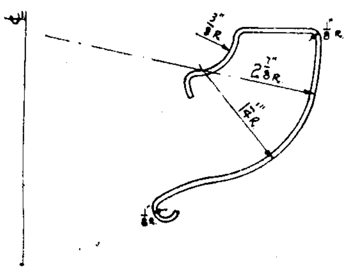
The casting was gripped internally, and the outside turning completed at this operation, including the short male portion, threaded $\frac{1}{8}$ in. B.S.P. The large outside radius on the bowl was checked for accuracy by using a cardboard template A.



TEMPLATE A



TEMPLATE B



HANDLE - 2 OFF

By means of a split brass ring the $1\frac{1}{2}$-in. diameter spigot was gripped and work commenced on the inside. This proved to be a most tricky job, as care had to be taken against cutting through at any point ; template B being used as a gauge. A very fine finish with no humps or bumps is most important when doing any work of an ornamental nature, as even very fine lines if left in are quite visible on the finished article.

A certain amount of chatter and squealing was encountered during this part of the job, but a rag tied tightly round the concave part of the diameter helped a lot to reduce this to a minimum, and the judicious use of the motor switch in cutting and reviving the speed of the lathe eventually cancelled out most of the remainder.

I should add that a certain amount of this noise was resumed when hand turning tools were next used, but this is inevitable in almost all ornamental work of this nature. Working carefully, and using the dodges referred to, obtained satisfactory results.

All my hand turning tools in their various forms are kept in a keen condition with all edges carefully rubbed down on the oilstone to remove the "grain" of the grindstone, as this can be imparted to the work-piece to the latter's detriment.

The general aim when doing this operation was to keep the walls of the bowl of a uniform thickness, approximately 3/32 in., and certainly not more than this. When this was achieved and no more

turning required, small pieces of carborundum were held in the fingers and applied to the job with the lathe running at top speed.

Two or three grades were used, finally finishing with a very ancient piece having a negligibly abrasive surface, and a very high finish resulted. Rubbing with a piece of rottenstone applied with a clean cloth brought up a brilliant polish.

Having the top part completed, work was started on the stem or bottom portion, and this was gripped on the small end and turned and finished on the outside. Also, at this setting, it was bored up the inside and tapped to correspond with the male thread on the top part. Before removing from chuck, it was lightened as much as possible on the inside and a short recess cut to accommodate the spigot base.

A brilliant finish was again achieved by the methods described earlier, before screwing on to a mandrel threaded ⅛ in. B.S.P., and the small end diameter faced and finished.

Regarding the base, I was fortunate in securing a fairly large sized piece of ebonite which filled the bill nicely, but any close-grained wood would do, as it could be stained black at the finish.

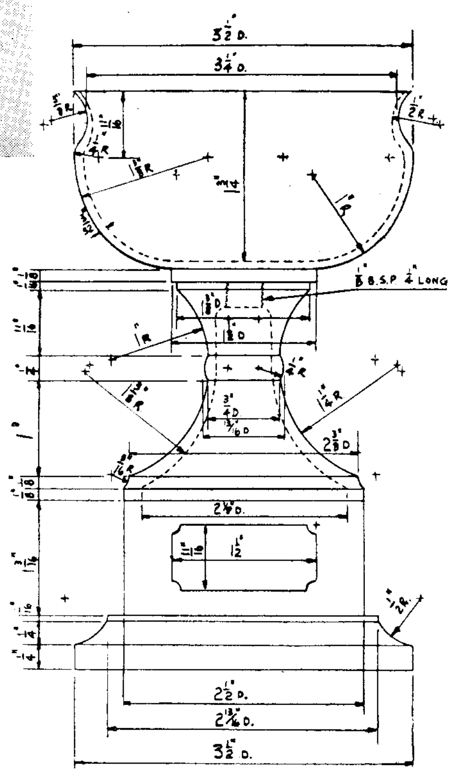
Turning the base was a straightforward job, a short spigot being left a tight push fit for the recess in the stem.

A piece of sheet brass approximately 1/32 in. thick × ½ in. broad was next procured for the handles, and was shaped and formed as shown on the sketch, afterwards being carefully sawn down the centre. After removing all marks and smoothing down to satisfaction, these were silver-soldered to the bowl. Thereafter, the plate was fixed to the base, suitably inscribed and sent to be chromium plated.

I am very pleased with the result of this experiment, which has met with considerable success, and I feel that several avenues have been opened regarding work of a similar nature. Perhaps, with the Editor's kind permission, another example may be described some time in the future.

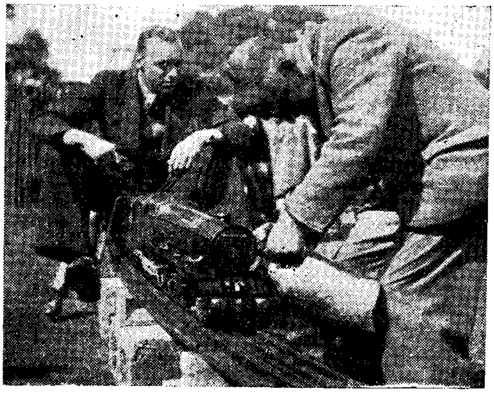
Left—Showing the portions of the cup before assembly

Photos by] [*W. Bell*



Dimensioned details of the lathe-made cup

Simpson's Day, 1949



WHIT SATURDAY was selected, this year, for that homely and hospitable function known as Simpson's Day, when Mr. S. W. Simpson, of Brentwood entertains members of the Society of Model and Experimental Engineers at his home.

To Major D. H. Chaddock and Mr. Tom Lawson we are indebted for notes from which the following account has been compiled, while Mr. G. H. W. Randell has very kindly supplied the photographs, here reproduced.

Mr. Simpson had laid his well-known multi-gauge track in a field, and alongside it was a marquee in which hospitality was provided.

Among the locomotives put in steam were: Mr. O. Seyd's 3½-in. gauge L.N.E.R. Pacific and 5-in. gauge 0-4-0 tank engine; Mr. H. E. White's 4-6-0, 0-6-4, Garrett for 3½-in. gauge, and two very fine Pacifics brought from Norwich by Messrs. P. Hill and F. Jarvis, both engines being "on trial."

Mr. Simpson's 3½-in. gauge Caledonian 4-4-0 revived some pleasant memories of pre-group days, and ran well.

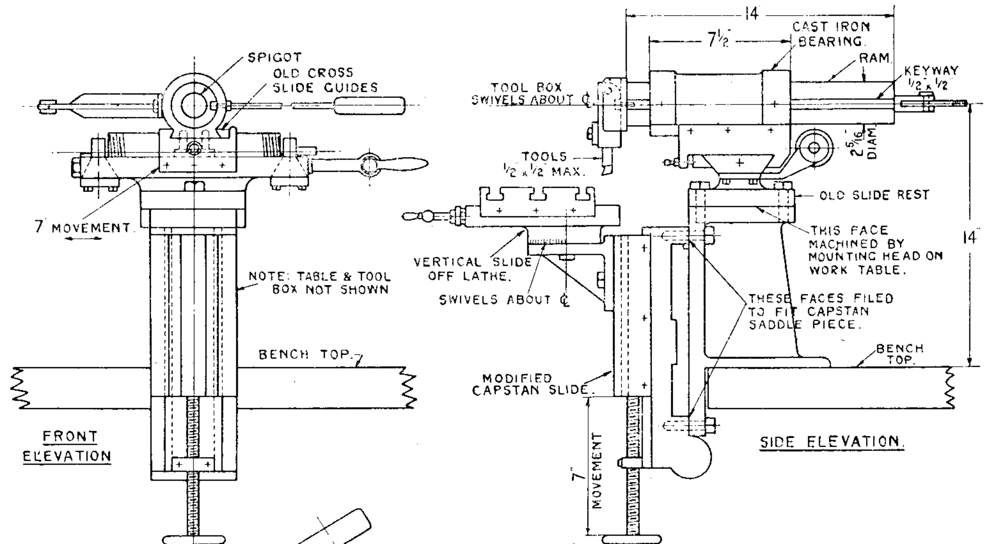
During a lull in the proceedings, Mr. J. C. Crebbin put into action a little oscillating-cylinder 0-2-2, spirit-fired engine, now more than 60 years old. To the astonishment and intense amusement of the onlookers, this little engine fled round the track like an antelope! But Mr. Simpson replied to this by producing an equally venerable, and genuine "Ajax" which showed that, given a fair wind and intervals for recovering "breath," it, too, could still lap the track.

Then came an interval during which everybody present enjoyed an excellent tea. After that, more running until the time came when the guests, with much reluctance, had perforce to depart. Mr. and Mrs. Simpson, their family and a number of helpers won the gratitude of all the guests for the enjoyment of another of those "Days" which are so prominent a feature in the S.M.E.E. calendar.

A "SHAPO-MILLER"

by F. W. Waterton

SOME fourteen years ago I felt the need of a machine tool of some sort which would produce a planed surface. At that time the workshop consisted of a pedal lathe with no backgear, and a home-made compound rest which clamped to the lathe-bed and a bench with the usual fittings. Milling in the lathe was next to impossible, and so I decided to make a shaping machine which is the subject of this article. The cheapest way to achieve this appeared to me to use as many parts of old machines as could be found in the junkshops.



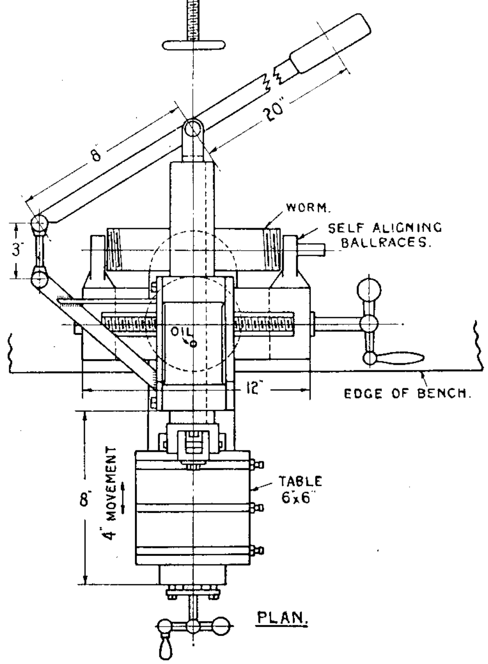


Fig. 1. *Three views of the "Shapo-Miller"*

Price was an all-important consideration. An old-established woodworking shop in Manchester supplied me with a somewhat rusty, but solid-looking compound slide-rest off what must have been a 6-in. lathe of vintage before 1900. This looked like a start, and at 2s. 6d. was considered a sound investment. The bottom-slide was 12 in. long with ways 3½ in. across and had a flanged base, 5½ in. diameter, with two ⅝-in. holes for bolting to a slotted bar, which was used to clamp the slide to the lathe-bed. If I removed the top-slide and replaced it with a bearing for the shaper ram, it looked as though the cross-feed problem was solved. A letter was then written to a Midland firm of tool breakers who used to advertise in these pages, asking for a single slide something like the parting-off slide from a large capstan, and also an angle-plate.

Fortunately, both these articles were forthcoming, the slide some 20 in. long × 4½ in. wide with a hefty screw and hand-wheel and a solid, but battered looking angle-plate, 6 in. × 6 in. × 6 in., and all for the sum of 25s. Now there followed a period of intense juggling with the

pieces, and all sorts of combinations were tried both on paper and on the floor. Several friends called round with suggestions both helpful and otherwise for the ultimate disposal of my three pieces of scrap. However, I was badly bitten with the idea of a shaper, and it seemed to me with a bit of a wangle I had a milling machine as well. This was suggested by the parting-off slide, which had a couple of tee-slots running longitudinally. Finally, the arrangement shown in the drawing, Fig. 1, was decided on and it enables the machine to be used as a shaper or miller at will. The old slide-rest was used to give the cross traverse and carry a cast-iron bearing mounted in the guides for the top-slide. This bearing was made to carry a circular ram fitted with a square keyway to prevent it turning when shaping. The key was to be bolted and dowelled to the inside of the bearing so that when milling, the bolts and dowels could be removed and the key go round with the ram, which then became the milling spindle.

Hand Work on the Slide

The parting-off slide was found to be badly worn for the top 3 in. where there was a cross tee-slot, but the slides and screw were as good as new. The tail end had an 8-in. apron which covered the leadscrew. This brought the hand-wheel inconveniently near the floor, as the upper end was badly out of truth. Some hard work with a hacksaw removed about 30 lb. of cast-iron which was not very useful. Both ends of the slide were cut off as indicated in Fig. 2. The sliding portion was now 8½ in. long, and had two tee-slots running longitudinally and open at both ends.

It was decided that this should supply the vertical movement and carry the angle-plate already mentioned as a table which could be moved up and down in the slots, or swivelled round at will. Another pattern was made for a cast-iron bracket to join the parting-off slide and the old slide-rest together, as shown in Fig. 1. While this was away at the foundry, the lathe slide-rest was stripped and found to be too badly pitted and worn to be scraped up, and so was taken to a friend's hand-planing machine to be planed up. After many hours planing and scraping during which the quality of the casting caused much vituperation—it was full of extremely hard pebbles about ⅛ in. diameter—the slide was fitted to the cross-slide carriage. The casting for the combined ram and milling spindle bearing had by now arrived, and a piece of hard shaft steel 14 in. long by 2½ in. diameter was obtained for the ram. When I examined the piece of shafting, I was dismayed to find that it was about 3/32 in. out of straight, but as my fond parent had obtained it for nothing and brought it home out of pure kindness of heart (it weighed nearly 20 lb.), I could only smile and do the best I could to eliminate the bend. This "struggling bar," as it came to be known, very early in its existence was centred at each end with a Slocomb held in a hand-drill, and then mounted between centres in the lathe, and an attempt was made to turn it something like true. After about three weeks' endeavour I had managed to face and turn a spigot on both ends and cut off most of the bow, but as the top-slide travel on the lathe was only 5 in., it was not possible to get the bar true over its full length. I gave it up at the finish, and the bar and its bearing casting were taken away to a local machine shop and were turned and bored to fit each other. The owner of the machine shop was sufficiently impressed by my efforts on the pedal lathe to machine the parts for nothing. He must have thought I deserved some encouragement. I know I thought so myself. At the same time, this good samaritan planed the keyway in the ram and a key was then filed and scraped to fit from a piece of ½-in. square bright steel bar. In the meantime, the casting for the main bracket had arrived, and this was filed up and drilled for four ½-in. bolts to fix on to the saddle of the parting-off slide. The bearing for the ram was fitted to the guides of the cross-slide with a view to using these to give a sideways adjustment to the milling-cutter. This idea was dropped later, as the slides were at 60 deg., and when used as a shaper the wedging action was too much for the gib screws, and the bearing lifted at the front end due to reaction from the cut. This bearing is now bolted down by four screws which pass through the saddle.

The lever for working the ram and the fulcrum bracket were built up from bright steel bar, and a file handle serves for a grip. These were all fitted to the bearing, as will be seen from the illustrations. The cross-slide with the ram and its fittings were then assembled as one unit. The main bracket and the vertical-slide assembly were bolted to the bench and the angle bracket bolted to the vertical-slide and squared up.

The cross-slide assembly was then mounted on the angle bracket and the top of the main bracket was planed up with the machine itself. The cross-slide and ram were then removed from the angle-plate and bolted to the main bracket in their correct position, the angle-plate remained to serve as a table. The sawn-off end of the vertical traverse-slide was then planed up. The machine remained in this condition for several years doing yeoman service on many different jobs.

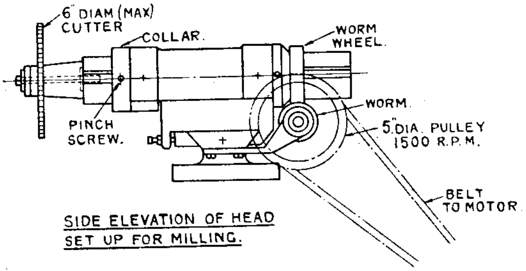
Collars

About 1939, two collars were made to fit the ram and a stepped collar made to bolt on to the end of the ram (using the same tapped hole which held on the clapper tool-box) to take standard milling-cutters and saws. The collars could be moved along the ram to give sideways adjustment to the cutter, but setting the cutter and the job to an exact position, e.g., when gear-cutting was difficult and the need was apparent for the side adjustment which I had been forced to discard because of the lifting of the ram bearing in its guides to which I have referred already. At this time the spindle-cum-ram was rotated by screwing my breast-drill handle on to the rear end of the ram and turning by hand. Some useful work was done with this arrangement, but some jobs were hard work, and gear-cutting was particularly tedious. However, the machine proved itself, and on one occasion I pushed a

$\frac{1}{4}$ in. wide × 6 in. diameter saw through a 4-in. × 1-in. bronze casting in about half an hour.

Since the war a motor drive has been rigged up for milling operations. This was achieved by fitting a worm wheel to the rear collar on the spindle and driving it with a long worm, running the full length of the cross traversing-slide. This gave a spindle speed of 50 r.p.m. with the worm running at about 1,500 revs. A 5-in. vee-pulley is mounted on the end of the worm shaft, which runs in ball-races fitted in cast brackets, which are bolted to the underneath side of the slide. The motor is a $\frac{1}{2}$ h.p. single-phase, 3,000 r.p.m. machine, which also does duty as a grindstone and polishing head. A vee-pulley was fitted to the shaft between the grindstone and the motor bearing, and the belt is just slipped off when not driving the milling arrangement.

Unfortunately, owing to the small size of the workshop which limits accessibility to the motor, it was found to be necessary to run the motor in opposite directions for grinding and for milling. After much thinking the following extremely simple reversing arrangement was fitted to the motor (see Fig. 3). The starting winding leads were extended with flex and brought out of the terminal box and connected



SIDE ELEVATION OF HEAD SET UP FOR MILLING.

to a two-pin plug top. The corresponding plug socket was mounted on the terminal cover of the motor and connected to the running winding and so to the mains via the usual switch. If the plug was put in one way the motor runs clockwise, and if put in the other way anti-clockwise, as the two-pin plug acts as a double-pole change-over switch for the starting winding.

About this time a new vertical slide was bought from a local firm and with a new right-angle bracket welded up from steel plate, it serves as a table and also provides the much needed fine adjustment parallel to the spindle for milling operations. The slide is also used on the lathe in its correct function as a vertical-slide when required. The lathe has incidently acquired a new slide-rest which traverses along the bed, and most of the machining for the saddle and cross-slide was carried out on the shaper.

The machine as a shaper has a stroke of 7 in., a cross traverse of 7 in., and a vertical screw traverse of 7 in. The distance of the tool point from the floor and from the workshop walls sets a limit to the size of the job which can be handled at right-angles to the cut.

As a miller, the travel of the cutter is 7 in., the coarse side adjustment about 5 in., the fine side adjustment provided by the slide is 4 in., and the vertical screw adjustment is 7 in. With hand operation for shaping and milling and with the angle-plate as a table, the machine cost me less than two pounds, and less the motor, the cost to date is a little over five pounds.

As a shaper the machine's limit seems to be

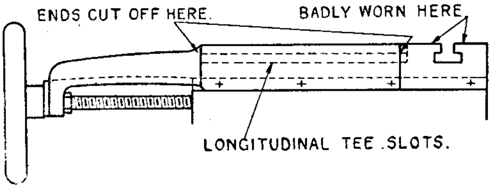


Fig. 2. Modification to capstan cross slide

the strength of the right arm of the operator, and I have occasionally bent $\frac{3}{8}$ in. square tools or just been unable to move the lever when in a hurry, and I have been too greedy with the feed. As a miller, some chatter is experienced if the slides of the cross traverse are not kept fairly tight, as the worm drive tends to pull the cutter into the work. The slide really requires a new screw, as there is about a $\frac{1}{16}$ in. backlash in the nut which does not help matters. I intend to make one some day.

The machine must weigh about 150 lb. altogether, and the bench it is on is beginning to give at the knees, as every fitting which is put on, adds a bit more to the load and so the strengthening of the bench is another job on the waiting list. I can recommend the arrangement for anyone who has a small workshop and a small pocket. As a time-saver the machine is without peer, and the change-over from a shaping set-up to milling can be made in less than five minutes. At a later date it is hoped to modify the end of the ram at take a chuck, etc., when, in addition to shaping and milling, the device will become a boring and facing lathe of about 9-in. centres.

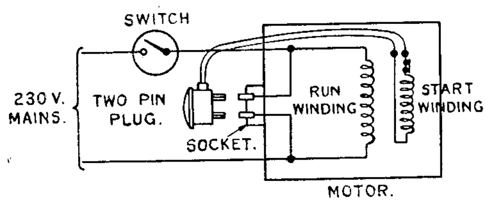
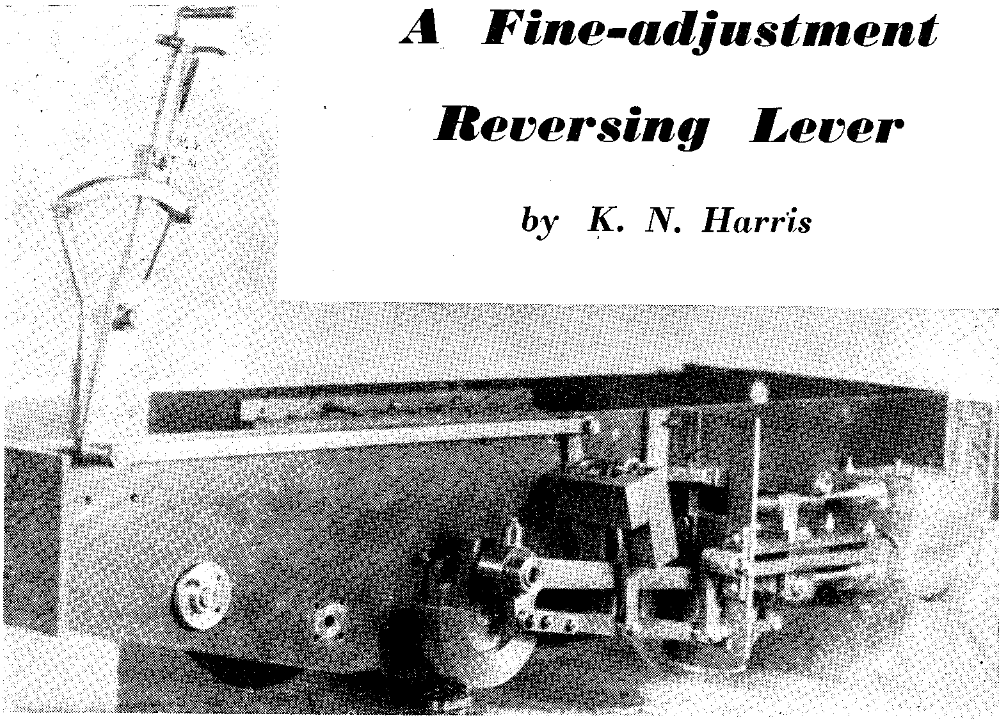


Fig. 3. Reversing arrangement for motor

In conclusion, I would like to record that I obtained a great deal of satisfaction out of making and using the machine, and cannot help thinking that the chap who just goes and buys his equipment gets it much more easily and quickly, but also misses a lot of fun.

A Fine-adjustment Reversing Lever

by K. N. Harris



Lever controlling Greenly-Joy valve-gear on a $3\frac{1}{2}$-in. gauge 0-4-0 locomotive

SOME time back, there was published a design of mine for a reversing lever and quadrant providing for fine adjustment and rigid holding in place of the lever, against the working stresses of the valve-gear.

The photographs herewith show a lever of this general type which I have completed for a model locomotive; actually, one of the photographs shows it in place on the locomotive chassis connected by its reach-rod to the slide-shaft of the Greenly-Joy gear.

The teeth in the quadrant are 40 d.p., and the quadrant itself is part of a wheel which, if complete, would have had 160 teeth, its d.p. being 4 in. It was cut on an ordinary horizontal milling-machine with a No. 1 cutter (135 teeth to a rack) between a pair of dividing-heads, the worm of which was a two-start one, working into an 80-tooth worm-wheel.

A 16-hole ring on the division-plate was used and the indicator arms set to span five holes, an *effective* movement of the worm of a quarter of a turn.

The quadrant detent was an awkward job; it was originally contemplated to mount it on a special cranked mandrel, between the dividing heads.

This would have meant quite a lot of work in the making. One of my colleagues, however, came across with an excellent suggestion; why not set it on top of a post on a rotary table and utilise the vertical feed on the milling-machine? This was much simpler and was immediately adopted. Care had, of course, to be exercised in setting the detent blank initially so that its face was truly radial to the axis of the table and exactly the right distance from it; as it was part of an *internal* gear, its face, i.e. the line of the tops of the teeth, was *nearer* the centre than the pitch-line by 0.025 in., the addendum of a 40 d.p. tooth.

Of course, the detent is itself part of an internal gear-ring of 160 teeth.

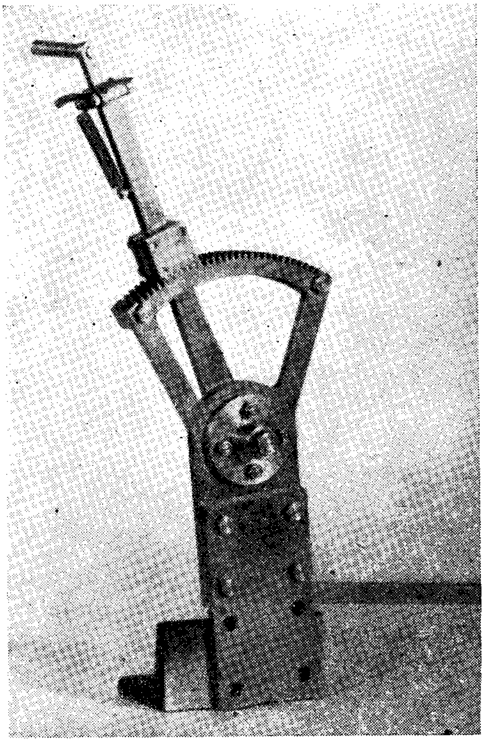
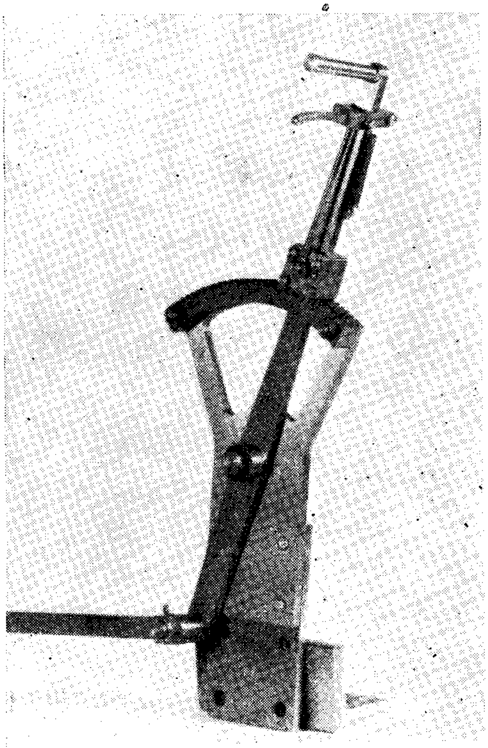
The rotary table was indexed in degrees directly and into 10 min. on the worm shaft. The necessary division was $2\frac{1}{4}$ deg. $\left(\frac{360}{2.25} = 160\right)$ and this meant $13\frac{1}{2}$ divisions on the worm-shaft for each tooth. Again the No. 1 cutter was used. The table was locked for each cut.

The detent is made in halves, set-screwed and taper pinned together, with, of course, suitable spacers.

It will be observed that the handle and catch lever are mounted at right angles to the main lever, a practice which I find (where there is room for it) facilitates handling.

The detent has 6 teeth, so possesses ample strength, and the quadrant provides for 9 *settings on each side* of mid-gear; it thus gives all reasonable degree of fineness in the adjustment of cut-off, whilst retaining the undoubted advantages of lever control for an up and down track.

The lever is $4\frac{1}{2}$ in. from pivot to handle and 2 in. from pivot to reach-rod pin. With the exception of the spacers between the detent

Lever quadrant and bracket. Left—Driver's side ; right—outside

sides, which are of brass, everything else is of steel. All bolts, nuts, studs, joint pins, etc., were made specially for the job.

The extension-piece, bolted on to the quadrant-plate, is itself bolted to the engine right-hand main frame, the main quadrant frame seating on top of the said main frame. The plate work is all of mild-steel $\frac{1}{8}$ in. thick.

The reach-rod is a piece of $\frac{1}{4}$ in. $\times$ $\frac{1}{8}$ in. flat mild-steel rod and the bosses at the ends are brazed on.

They were made by turning a piece of mild-steel to 11/32 in. diameter, the requisite diameter for the bosses putting a $\frac{3}{16}$-in. hole down it, and then cutting a slot in the end to accommodate the $\frac{1}{4}$-in. $\times$ $\frac{1}{8}$-in. rod. A length equal to the required length of the boss was parted off and brazed to the reach-rod.

The second boss was made in the same way and its position carefully determined, after which it, too, was brazed in place. The ends of the rod were trimmed up to conform with the bosses and the $\frac{3}{16}$-in. holes, the lower portion of which were, of course, blanked by the rods, drilled right through and opened out to 7/32 in., the diameter of the joint pins.

This general principle was described in THE MODEL ENGINEER over 30 years ago by Mr. E. W. Twining, actually as applied to making coupling-rods. The principle is a most useful one, has many applications and is a great saver of time, labour and material.

There is, buried in old volumes of THE MODEL ENGINEER, an absolute mine of information, hints, techniques, descriptions of special tools and rigs, methods and gadgets which would be of the utmost use to present-day readers.

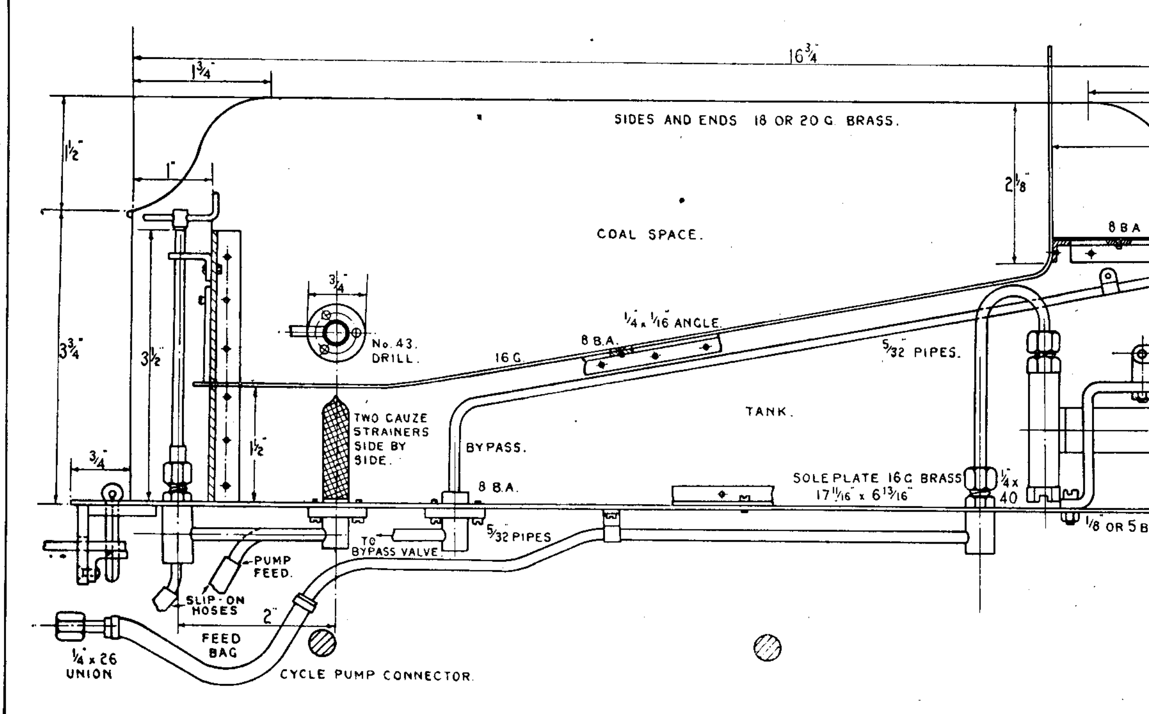
As has undoubtedly been pointed out before, the stresses set up in a valve-gear, particularly when moving a slide-valve under high pressure, are very considerable indeed, and many of these are transmitted to the actual reversing-gear ; if this is not robust and rigid, not only does rapid wear ensue in consequence, but valve events go completely haywire.

For combined rigidity and really sensitive control over the setting of the valve-gear, there is, of course, nothing to touch the screw and wheel (or handle), preferably with a notched-wheel locking device, and where an engine is going to be used for most of its working life on a continuous track, then I should recommend its use every time. For an " up and down " track, however, a lever is preferable and the type described does strike a compromise between the normal type with only two or three positions between full and mid-gear and the infinitely variable screw type.

A $3\frac{1}{2}$-in. Gauge L.M.S.

by " L.B.S.

WHEN finishing the description of the internal fittings of the tenders for " Maid of Kent " and " Minx " in the issue for June 2nd last, I mentioned that the arrangement for " Doris " would be practically the same, so that no detailed repetition of the instructions would be needed. If you do what our 'Oxton friend Bert Smiff would call " tike a dekko " at the reproduced drawing, you'll see that the layout is practically identical, except for size, and one or two unimportant differences, such as the lengths of the copper pipes. Having more " overhead " room in the front part of the tank, the gauze strainers for the pump and injector feeds can be placed much nearer to the front plate, than on the larger tenders, and the copper pipes kept shorter, which is an advantage. There is a bit of difference in the body itself, apart from its smaller size, as the high sides slope inwards to match the curvature of the cab roof, as shown in the end view. Personally, I don't care overmuch for a high-sided tender on a little engine, and would have preferred the medium one as fitted to the " Princess Royal " when she first came out, and also to some of the older classes of tender engines ; but I guess if I specified it for " Doris," Inspector Meticulous would be leading a gang of his followers to our hacienda in double-quick time—and though I would prefer a quick finish, I want it to be peaceful ! Incidentally, I fitted a high-sided six-wheeled tender to " Tugboat Annie " ; not from choice, but because I wanted her to be able to use existing turntables if reproduced in full size, and naturally had to make up in height, what I lost in length, to get the capacity. " Grosvenor " has a very long tender, nearly as long as the engine, as per big sister. Billy Stroudley's idea in providing the long tenders, was to get the required capacity without having the tender high enough to risk the chance of a fireman getting scalped, if he happened to be standing on it for any purpose, when the engine passed under a bridge. Firemen frequently stood on the shovel plate, to pull the coal forward, as the coal space was shallow.



Section and front end of ten

Soleplate, sides and back

As with the larger tenders, hard rolled sheet brass is about the best material to use ; but the alternatives, such as lead-coated steel or galvanised iron, would do at a pinch. The soleplate should be 16-gauge, and the sides, back, front plate and tank top 18- or 20-gauge. For the soleplate, a piece of 16-gauge metal measuring (when

M.S. Class 5 Locomotive

"L.B.S.C."

finished) $17\frac{11}{16}$ in. by $6\frac{13}{16}$ in. will be needed. This is attached to the top of buffer and drag beams, and the side angles, by 6-B.A. brass screws, nutted underneath, as described for the "Maid" and "Minx."

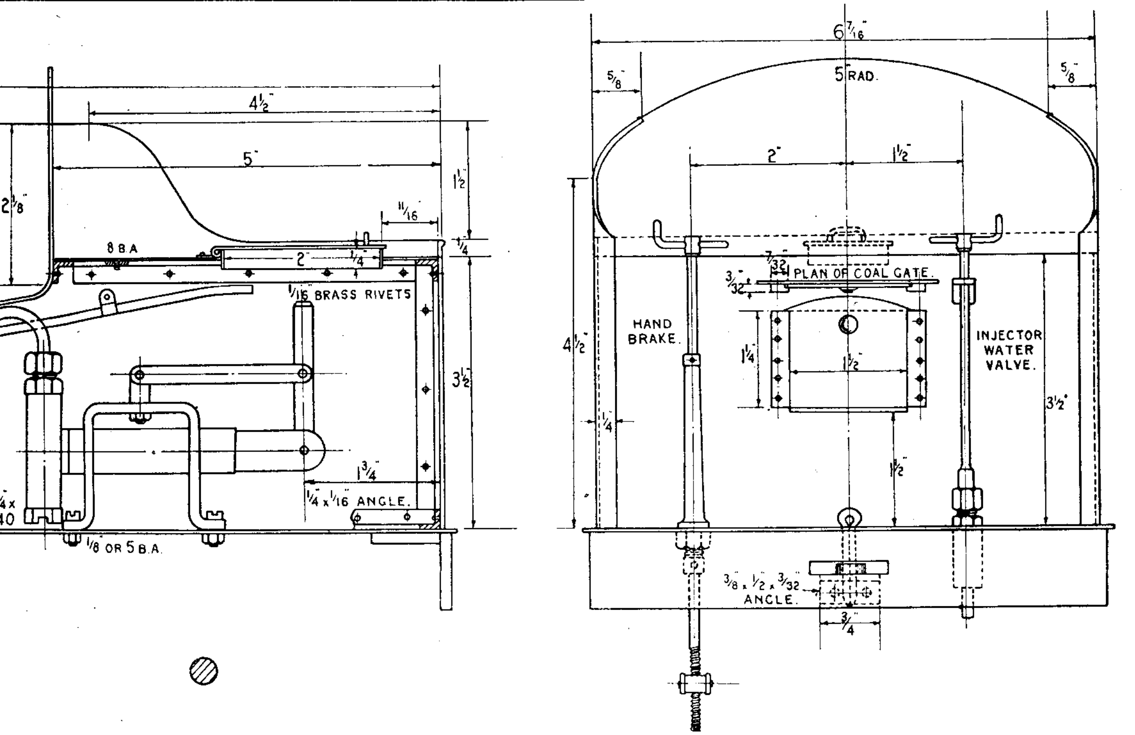
If a piece of sheet metal big enough to make sides and back in one piece, is available, do it that way. If not, use three pieces, two sides and a back. The two sides can be cut together, like frames, which will ensure beginners getting them both alike. If using three-piece construction, rivet on the inside angles to both sides and the back sheet, before erecting the body. This makes the job very easy. The sides and back are joined by pieces of angle riveted into each corner. If you use a toolmaker's cramp at each end of the angle, to hold it to the body sheet, the riveting is also a cakewalk, and the body should come out nice and square. Take my tip and don't bother about ornamenting the outside of the body with half-a-million rivet heads. I've got nothing whatever against the good folk who delight in that sort of thing; in fact, I honestly admire their skill and patience; but, as welding is now in vogue for building up tenders, and some of them haven't a single rivet in the whole bag of tricks, Inspector Meticulous can't do a (deleted by censor) thing about it if your tender sides are perfectly smooth.

If the body is bent up from a single sheet, leave the angles until the front plate is fixed, otherwise the sides will try to flap about like wings when you start riveting in the angles. When the front plate is in, it keeps the lot square.

Front plate

On the full-sized tender, the front plate is practically the same height as the top of the cab. That is all right when the driver and fireman ride on the footplate, but entirely out of court when the engine has to be fired and driven from the back of the tender. We therefore fit a low front plate, with a coal-gate like the old Brighton engines had. You can leave out the coal-gate altogether if you so desire, as it is never used; the only reason I specify it, is because the front plate looks bare without one. Some of the old tenders with a horseshoe-shaped coal space, didn't even have a front plate at all, let alone a coal-gate. The unfortunate fireman had to shovel up the coal from the footplate or floor level, and a back-breaking job it was, as you may guess.

There is no need to bother about riveting bits



front end of tender body for "Doris"

of angle to the ends of the front plate, for attachment to the sides of the body. Just cut a piece of metal, same stuff as used for body, $3\frac{1}{2}$ in. wide, and long enough to fit between the sides of the body when same are parallel, plus $\frac{3}{8}$ in. each side. These $\frac{3}{8}$-in. extensions are bent over at right-angles to the plate, in the bench vice, and riveted to the body sides, with the angles pointing to the back of the tender, at 1 in. from the front ends of the body. Fit the coal-gate before riveting in. The opening for it is $1\frac{1}{4}$ in. deep, and $1\frac{1}{2}$ in. wide, the bottom of the gate being $1\frac{1}{2}$ in. from the bottom of the plate. The runners, and the gate itself, are made exactly as described for the 5-in. gauge jobs.

If the sides and back are a one-piece job, the angles inside can now be fitted. Locate them with a cardboard template, as described for "Maid" and "Minx." Then fit the body to the soleplate. The front ends of the body are $\frac{3}{4}$ in. from the end of the soleplate, and the body is set midway between the sides, so that the narrow "gangway," as the Brighton enginemen called it, is the same width each side of the tender. Drill clearing holes in the bottom angles before you locate the body "for keeps," then attach it by 8-B.A. or 3/32-in. brass screws, to the soleplate. Finally, sweat up the joints with a good big soldering bit, all around where the body is attached to the soleplate. Don't forget to cover the rivet and screw heads, and don't use a paste flux.

Internal Fittings

It is advisable, especially for beginners, to install the pump, strainers, by-pass pipe, and injector water valve, before putting on the top plates of the tank, as you can better see what you are doing. The parts named, are made as described for "Maid" and "Minx," and are fitted in exactly the same way, so I needn't go over all that ground again, but only mention the slight differences. One is, that the distance between the centre of the injector water valve, and the strainer attached to it by the 5/32-in. pipe, is only 2 in. The clearing hole in the soleplate for the stem of the injector water valve is drilled $1\frac{1}{2}$ in. from centre line of tender (on your right, if you are looking at the front plate) and $\frac{3}{8}$ in. ahead of the front plate itself. The hole for the strainer is, of course, in line with it, 2 in. to the rear, as the sergeant-major would remark. The strainer for the pump feed is set level with its mate, but about 1 in. on the opposite side of the centre-line. The exact position of the by-pass fitting doesn't matter a Continental, as long as the end of the pipe is led to the filler hole, so that you can see the water squirting out of it when the valve is open. The location shown, $1\frac{1}{2}$ in. behind the strainers, is as good as any, as only a short pipe is needed underneath.

Locate the hand pump with the centre of the operating lever $1\frac{3}{4}$ in. from the back end of the tank, when the handle is vertical. The swan-neck pipe and the union fitting are same as "Maid" and "Minx," and I have shown a "feed-bag," as the enginemen call it, made from a bit of high-pressure hose such as used on cycle-pump connectors, in place of the usual coiled pipe. This is ever so much more flexible than the pipe; a stiff connection is a frequent cause of derailments on curves, as I have found on my own railway when an engine belonging to one of my few personal friends, has come off the road on the south curve for no apparent reason whatever. Disconnecting a stiff feed pipe has completely cured the trouble on more than one occasion.

Bending Tip for Beginners

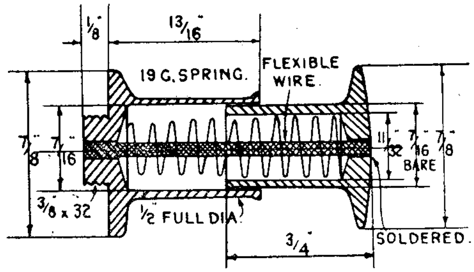
To get a nice clean bend at the top of each side of the tank sheets, without making the metal look as though it had been used for target practice, here is a wheeze which I always used before the "Diacro" bending brake landed in my workshop. Take out the two steel insets from the jaws of your bench vice; and in their place, put a couple of bits of round steel rod about 15 in. long and about $\frac{1}{2}$ in. diameter. Grip the upper edge of the tender sheet between these rods, tighten the vice jaws, and by mere hand pressure on the metal, you can get a lovely even bend without any signs of marking. The front corners of the tender body can be curved inwards by same process, but naturally this will have to be done before the body is screwed down to the soleplate.

Tank Top

It would be advisable to make the fixed part of the tank top from fairly stout plate, say 16- or 18-gauge, as it carries the coal—not so much for reasons of weight, but for shovelling. A piece 14 in. long, and just wide enough to fit nicely between the tank sides, a bare $6\frac{3}{8}$ in., will be needed. The front corners of this are cut away to leave a projecting lip $1\frac{1}{2}$ in. wide and about $\frac{1}{4}$ in. deep, to fit the bottom of the coal-gate opening. The back is cut to a radius of 5 in., and the complete plate bent to the shape shown in the drawing. Try it in position, and mark on the back of the vertical part, the position of the angles at each side of the tender body. Remove the plate, and rivet on a piece of $\frac{1}{4}$ in. by $\frac{1}{16}$-in. angle, to form the front support of the removable part of the tank top. Replace the plate, screw it down to the side angles with 8-B.A. countersunk screws at about 1 in. centres, then solder it all around to make it watertight. Don't forget to solder over all the screwheads, and under the lip where it projects through the gate. The soldering can be carried right up to the top of each side, above the actual tank, as this will help to strengthen the tender body. Note, there are no angles fitted at each side of the coal-gate; none are needed, as the strength of the soldered joint is ample here, the side angles and the bottom of the coal-gate opening providing all the support needed.

The removable part of the tank top is merely a piece of 18- or 20-gauge sheet metal, cut to an easy fit between the sides, end, and fixed plate; this will measure approximately $6\frac{5}{16}$ in. by $4\frac{7}{8}$ in. Drill No. 43 holes all around, at 5/32 in. from the edge, at about 1 in. centres. Fit a filler and lid, same as described for the 5-in. gauge tenders, but to the sizes given in the illustration. Note, as the filler only projects $\frac{1}{8}$ in. above the tank top, the hinge loop will lie flat on same, and can be attached by a screw as

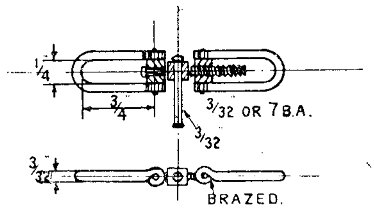
shown, or merely soldered. The plate, with filler attached, is fixed in place by 8-B.A. by $\frac{3}{16}$-in. or $\frac{1}{4}$-in. brass screws, any heads you fancy. They run through the clearing holes in the plate, into tapped holes in the angles. A beading of 3/32-in. half-round wire, soldered all around the top edge of the tender body, and the curved top edge of the fixed plate, completes the bodywork.



Details of tender buffer

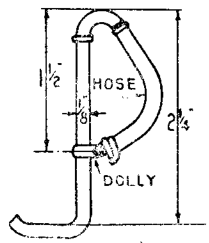
Buffers and Coupling

The fact that the ordinary type of buffer, with a spindle coming through the shank, fouls the side frames of the tender, cannot be helped, as the frame centres are only $\frac{1}{4}$ in. wider than the buffer centres. The way I have hitherto got over this, was by putting a rose cutter, or equivalent, down the hole in the beam, and cutting out a recess. As Inspector Meticulous raised an awful moan about that trick, I give here a sketch of a self-contained buffer which has no spindle, and only needs the support of the $\frac{1}{8}$ in. thickness of the beam, to hold it in place. The socket is turned the same as the engine buffers, except that the stem is only $\frac{1}{8}$ in. long, and has a 3/32-in. hole drilled



Screw coupling

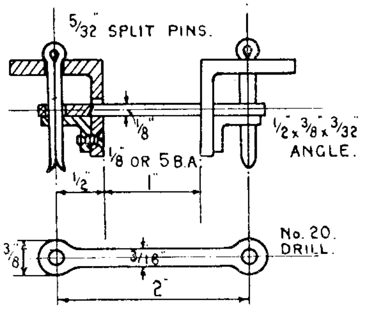
through it, instead of the long stem and bigger spindle hole of the engine buffer. Instead of the head being drilled and tapped for a spindle, it is drilled up with an 11/32-in. drill, to a depth of $\frac{5}{8}$ in., before parting off the rod, and a 3/32-in. hole is drilled in the end. In this hole is soldered a piece of flexible brass or copper wire; picture-wire would do, or a bit of electric flex with the insulation stripped off, doubling and trebling if necessary, to obtain the required thickness. Wind up a spring from 19-gauge tinned steel wire, and put it in the recess in the buffer head; then assemble the buffer, pushing the other end of the flexible wire through the hole in the stem. Enter the head about $\frac{3}{16}$ in. into the socket, then solder the projecting wire where it comes out of the hole in the stem. Solder should run right through the joint in both head and socket. Cut the wire off flush both ends, and smooth over the head end with a file, so that the wire centre is practically invisible. The bit of flexible wire prevents the head coming out, but it doesn't prevent it compressing in the manner usually observed among the buffer fraternity.



Brake pipe

If a casting is used for the socket, it will have a square flange. If turned up from $\frac{7}{8}$-in. rod, make it $\frac{1}{16}$ in. shorter than shown, leave the shank $\frac{1}{16}$ in. longer, cut out a flange $\frac{7}{8}$-in. square, from sheet brass or steel, 16-gauge, and silver-solder it to the socket. Either flange can be drilled No. 51 at the corners; then, when the buffer is screwed home in the beam, a $\frac{1}{16}$-in. or 10-B.A. screw in each corner, running into tapped holes in the beam, will prevent it making an unauthorised exit from the beam when the engine is at work.

The screw coupling is made in exactly the same way as those described for other engines in these notes, the ends of the wire shackles being



Coupling between engine and tender

filed half away, bent into a loop, and brazed or silver-soldered. If you block up the eye, just put a No. 43 drill through. Don't forget to put one end of one shackle through the hole in the drawhook (same as described for the engine part) before bending. Drill a cross hole in the boss in the middle part of the screw, with No. 48 drill; instead of a lever with a ball on the end, as in the other couplings described, fit what on the big engine is really a kind of glorified tommy-bar. This is just a piece of 15-gauge spoke wire, with

each end burred over a little, so that it can't fall out of the hole.

Details or Trimmings

The steps at each end of the tender, shown in the general arrangement drawing, are exactly the same as those at the cab end of the engine, and are fixed the same way, so nothing further need be said about the job. The dummy brake-pipe is made from $\frac{1}{8}$-in. copper tube or wire, the hose being a bit of rubber tube slipped over and secured with a weeny clip ; just a thin sliver of copper strip squeezed around with a pair of pliers. The dolly, or dummy coupling plug, is an 0000-gauge edition of a baby's soothing teat ; but instead of being a ring, the handle end is filed flat and attached to the brake-pipe by a strip of thin copper, bent round the pipe and pinned to the shank of the dolly. The free end of the hose is slipped over the teat, and the whole bag of tricks clipped to the buffer beam by a miniature pipe-clip, bent up from strip brass or copper about 5/32-in. wide, and attached to the beam by $\frac{1}{16}$-in. or 10-B.A. screws. Solder the pipe to the clip, to prevent the pipe slipping down.

To couple the engine and tender, drill a No. 20 hole on the centre-line of each drag-beam, $\frac{1}{2}$ in. from the end. Underneath the slot in each beam, rivet or screw a $\frac{3}{4}$-in. length of $\frac{3}{8}$-in. by $\frac{1}{2}$-in. by 3/32-in. angle, brass or steel. If you can't get unequal angle, use $\frac{1}{2}$-in., and file off what part of it projects below the beam. Drill a No. 20 hole in each, using the hole in the beam above it, as a guide for the drill. File up a drawbar, like a weeny coupling-rod, from $\frac{3}{8}$-in. by $\frac{1}{8}$-in. steel, as shown ; or you can simply use a bit of the rod, as it is, with the ends rounded and drilled at 2 in. centres ; use 5/32-in. commercial split pins to hold the drawbar in place, and if you drop one in the grass, don't waste time searching for it, but get another. Time is precious nowadays ! And for that very same reason, it is hardly worth while turning up handrail knobs from rod, and screwing and drilling them, when some of our advertisers can supply them at a reasonable rate. However, for those who prefer to make them, I will give (in the near future, all being well) a sketch of a form-tool and drilling-jig for making them. The location of the knobs, is given in the general arrangement drawings of engine and tender ; they can be screwed direct into tapped holes in the boiler shell, using a smear of plumbers' jointing on the threads, to prevent leakage. Those on the front corners of the tender, and near the back, can be nutted on the inside, as the metal of the tender is too thin to afford a hold, if the knobs were screwed in direct.

The Orpington Regatta

THE Orpington Model Engineering Society is one of the less fortunate clubs as regards suitable water for running power boats, but with the assistance of the Victoria M.S.C. a fine first regatta was held at Victoria Park, London, E. on Sunday, June 19th. One of the highlights was the setting up of a new Class B record (subject to official recognition) by Frank Jutton's flash-steamer *Vesta II* which incidentally is also a record for flash steam in any class.

The day's racing commenced with a Nomination race, combined with a long distance shot at the steering targets. A number of well-known craft showed their faces in this, together with several new boats. The various competitors were very near their nominated times in most cases, the winner being only 0.2 sec. out.

Result :

	per cent. error
1st Mr. Curtis (Victoria) *Micky*	1.5
2nd Mr. J. Benson (Blackheath) *Comet*	3.4
3rd Mr. E. Vanner (Victoria) *Leda*	4.1

Long Distance Steering Prize : Mr. Curtis (Victoria) *Micky*.

No C Class (restricted) hydroplanes being present the regatta continued with a 500 yd. race for the ordinary Class C boats, and this event showed several new boats in action for the first time in competition, among these were Mr. L. Pinder's new 10 c.c. boat which although not completing the course on either attempt, made a very fine showing. The winner of the event was Mr. B. Miles (Malden), who has long deserved some success in model power boat racing. The runner up was *Defiant III*, Mr. J. Cruickshank's well-known boat.

Result :

1st Mr. B. Miles (Malden) .. 42.25 m.p.h.
2nd Mr. J. Cruickshank (Victoria) *Defiant III* .. .. .. 25.5 m.p.h.

After a lunch interval, racing was resumed with a 500 yd. B Class race, and this race produced some fireworks from Frank Jutton's flash steamer *Vesta II*, although not completing on the first run, it fully atoned for this lapse on the next attempt, recording 47 m.p.h. for the distance, some laps of which were timed at over 50 m.p.h. unofficially !

A very creditable run was made by a new Victoria boat, Mr. Collins's *Pip*, in taking second place just beating Mr. G. Line's *Sparky* (Orpington).

Result :

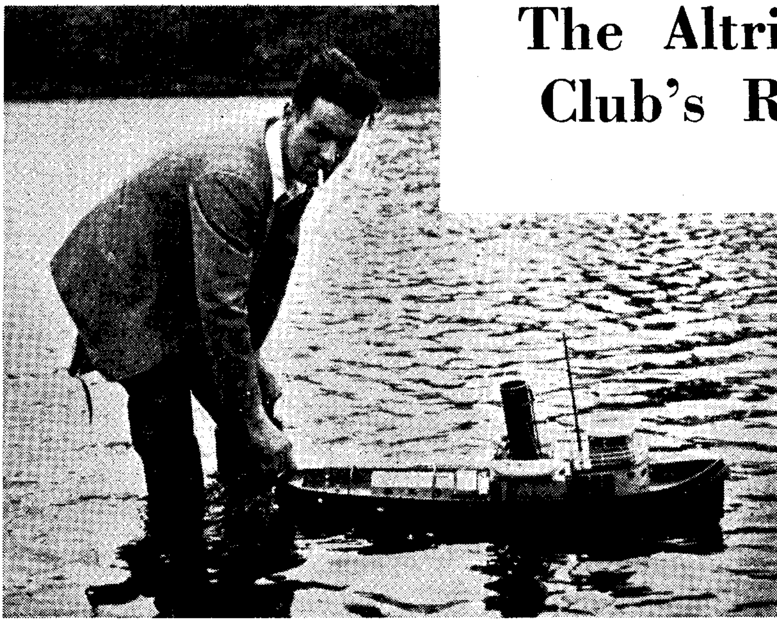
1st Mr. F. Jutton (Guildford) *Vesta II* .. .. 47 m.p.h.
2nd Mr. Collins (Victoria) *Pip* .. 32.5 m.p.h.

The Class A event which followed proved a disappointment, no competitors being able to get a run. The Class A record holder Mr. Clifford (Victoria) with *Blue Streak* was unlucky when the universal joint was damaged in starting up.

The final event was the steering competition, which, being run over a "slanting" course, proved difficult for most of the steering boats present, but was interesting from the spectators point of view nevertheless. It resulted in a win for the Victoria club, Mr. Mitchel's petrol-driven launch scoring 11 points.

Result :

	Points
1st Mr. Mitchel (Victoria)	11
2nd Mr. A. Rayman (Blackheath) *Yvonne*	7
3rd Mr. W. Gates (Victoria) *Squib*	6



The Altrincham Club's Regatta

Mr. Bagshaw, with his model tug "Dolphin"

THE Altrincham Model Power Boat and Car Club held their annual regatta at the sailing water of the N.A.M.E., in Heaton Park, Manchester, on Sunday, June 12th, 1949. The weather was kind, and all events were completed in nice sunshine, although in the early stages the water was choppy. The first event was a combined speed trial for 10 c.c. and 15 c.c. hydroplanes over 600 yd., and very soon the choppy water took its toll. The first boat away in the 10 c.c. class, belonging to Mr. Wraith, of Altrincham, and appropriately named *Misbehave*, did a very graceful submarine act on its first lap. Mr. Innes did better, with an, as yet, unnamed boat, and recorded a speed of 34.2 m.p.h., but things were still a bit too rough for these light craft. The 15 c.c. boats then followed, and Mr. Mitchell, of Runcorn, put up a really polished run with his boat *Beta* to record a speed of 40.3 m.p.h.; this was later followed up by another run at 42.3 m.p.h. The way this boat ran on the choppy water was a joy to watch; one would almost think it ran on rails. Mr. Dalziel, of the Bournville club, was unfortunate and did not complete the course, but Mr. Talbot, of the Runcorn club, ran second to his fellow clubmate and recorded 31.95 m.p.h. with his boat *R.U.2*. The Altrincham club members were unlucky, even Mr. Innes' *Satellite III* only being able to attain 26.3 m.p.h. Mr. Shaw, of the home club, did the 600 yd. at a modest 23.2 m.p.h., not at all up to his usual performance. His hydroplane, named *Bea*, is usually good for 34 m.p.h. or so. However, the visitors did not get it all their own way, for on the last run in this event Mr. Innes' 10 c.c. hydroplane managed to stay on top and put up the best speed so far, recording 44.7 m.p.h.

The next event was the steering competition, and Mr Bagshaw with his new petrol-driven tug *Dolphin* scored two bulls and a near miss, to record 10 points, while Mr. Bates and Mr. Turner tied with 2 points each, and each had another run. Mr. Turner's launch *Ann Russet* then scored an outer, while Mr. Bates's launch *Blue Mist* failed to score, so Mr. Bagshaw, of the Altrincham club, took first place with Mr. Turner second. *Dolphin* is a very nice boat and runs extremely well. Incidentally, the power plant is a 15 c.c. four-stroke of Westbury design and is fitted with a ducted fan on the flywheel for cooling, driving through a reduction gear to the propeller.

The 30 c.c. event followed after a short interval, and Mr. Williams, of Bournville, opened the proceedings with *Faro*, but failed to finish the course. He was followed by Mr. Tomkinson's 30 c.c. two-stroke engined boat, which, however, disappeared beneath the waves while running at a good speed. The engine in this boat is quite a snappy performer, and has 360 deg. transfer and exhaust ports, coupled to an extremely neat design of transfer passages. As is usual with Mr. Tomkinson, it is of his own design and construction. Mr. Waterton, also of the Altrincham Club, was unfortunate with his 30 c.c. two-stroke, being unable to complete the course. The next competitor was Mr. F. Westmoreland with a new boat, as yet unnamed, which completed the course, though misfiring badly, at 34.7 m.p.h.

The competitors then had their second runs, and Mr. Williams put up a beautiful run at 50.7 m.p.h. to win the event. Mr. Westmoreland increased his speed to 38.4 m.p.h. and took second place; this boat is interesting to the historian in power boat affairs, as the power plant was built by the present owner and his father, the

late Mr. F. Westmoreland, who, it will be remembered, was the first person to exceed 25 m.p.h. with a model hydroplane, the famed *Evil Spirit*. The last run in this event was by Mr. Meageen, of Altrincham, with a very interesting boat powered by a 20 c.c. two-stroke, very similar in design to Mr. Tomkinson's 30 c.c. engine, but fitted with glow-plug ignition, another interesting feature being the use of crankcase compression for pressure feed to the fuel tank. There is every indication that this boat will be very successful when the "teething" troubles are over, although it recorded only 24.8 m.p.h. in this event; this, however, was most probably due to cavitation.

Mr. F. W. Westmoreland, of Altrincham, with his 30-c.c. hydroplane

Mr. Talbot, of Runcorn, with his boat "R.U.2"

The results were as follows:

			secs.	m.p.h.
10 c.c. Hydroplanes—600 yds.				
Mr. Innes ...	... *A12*	... Altrincham	... 27.5	44.7
15 c.c. Hydroplanes—600 yds.				
Mr. Mitchell	... *Beta*	... Runcorn	... 29.15	42.3
Mr. Talbot	... *R.U.2*	... "	... 38.5	31.95
Mr. Innes	... *Satellite III*	Altrincham	... 46.75	26.3
30 c.c. Hydroplanes—600 yds. for Speed Cup				
Mr. Williams	... *Faro*	... Bournville	... 24.3	50.7
Mr. Westmoreland	—	Altrincham	... 32.0	38.4
Mr. Meageen	... *Gloplug* ...	"	... 49.5	24.8

Steering Comp.		*For Steering Cup*
Mr. Bagshaw ...	... *Dolphin* ...	... 10 pts.
Mr. Turner ...	... *Ann Russet* ...	... 3 "
Mr. Bates ...	... *Blue Mist* ...	... 2 "

Light Duties for Veterans

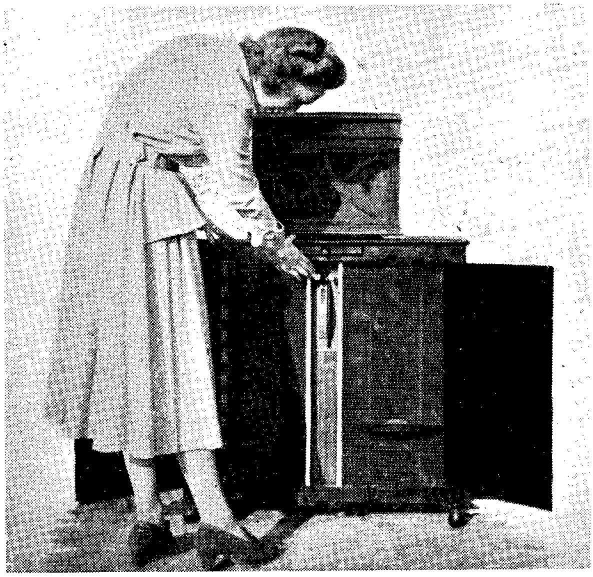
On a recent journey from Southampton to Reading, we travelled via Basingstoke, over the Western Region's 16-mile branch line from the Southern-Western joint station at Basingstoke. We noted that the trains on the branch were being worked by Western Region 2-6-2 tank engines of the 6100 class and Southern engines of the "N15X" class of 4-6-0 type. Our train was hauled by one of the latter, No. 2329, *Stephenson*, originally built in 1921 as a 4-6-4 express tank engine for the L.B. & S.C.R.

It might seem a little strange to find such an engine engaged on light branch-line duties; but *Stephenson* and a sister engine, No. 2328, *Hackworth*, have been fairly regularly used on this branch for some time now, working turn and turn about with Western Region 2-6-2 tanks and an occasional 0-6-0 pannier-tank.

We were delighted with the speed which *Stephenson* worked up between stops; 62 m.p.h. before Bramley, 58 m.p.h. between there and Mortimer, and exactly 60 m.p.h. at the approach to the junction with the main line at Southcote. As we neared the junction, we began to feel really uneasy! To be travelling at 60 m.p.h. at a bare half-mile from a 45-deg. junction is inclined to make an observant passenger feel uncomfortable. But our driver, at last, put the brake on, and we slid gracefully and sedately on to the main line at not more than 25 m.p.h.! The transition curves at this particular spot are, however, beautifully laid, and the train took them smoothly and easily. But *branch-line* traffic—what a job for a grand old engine with so much life still in her!

An Auto-unit Record Cabinet

by George R. Stevenson



NECESSITY being the mother of invention, this cabinet was the result of planning to accommodate some 180 gramophone records that were required for use from time to time. Some were housed in albums, others in paper envelopes, on shelves, in boxes, and at times merely in heaps on the floor. To find any particular record was a problem, swift if very lucky, a long and laborious job if otherwise. It was therefore decided that what was needed was a cabinet of some sort which would house the records in a dry and dust-proof condition. It must be capable of holding a good number of records, yet each one needed to be readily obtainable for playing. Whilst not strictly model engineering perhaps, the applications of fitting, lathe work and woodwork combined to produce a useful article.

A 200-record Container

The cabinet illustrated measures but 32 in. wide, 32 in. tall, and 17 in. from front to back; yet it contains 400 titles—that is, 200 records, mixed 10 and 12 in., any one of which can be selected and obtained in three to four seconds—an advertisement would call it "instantly." The design forms the subject of provisional patent No. 27586. At the top of the cabinet can be seen a shallow drawer; it contains a list of records under such headings as "Sonatas," "Concertos," etc., each record being given a number. The number is also noted on each record by means of a gummed tab on the label. The records are nested in horizontal racks. Those in the prototype model are built up from 12-gauge round steel wire covered with Deccofloc suede, scarlet; but a manufactured model would have racks of moulded plastic. The racks are spaced four to the in., so a total height of 25 in. holds 100 records. Each of these vertical banks constitutes a "unit," so that the cabinet illustrated is a 2-unit model. Between the two banks of records will be seen an operating board with a finger-controlled dial, two push-buttons marked "1" and "2" and a window through which is seen any selected number from 1 to 100. No electricity or other source of power is used; the selecting mechanism is finger-operated, only.

Selecting a Record

To select a particular record the dial is rotated until the last two figures of the required number are positioned in the window. Then, if the record belongs in the first hundred, button marked "1" is pushed; or, if the record belongs to the second hundred, then button "2" would be used. Thus the number 45 would be dialled for record numbered 45, and also for number 145, button (1) being used to obtain the former, and button (2) for the latter. On pushing a button, the record is delivered by sliding out from its rack to a distance of about half its diameter, as seen in the photograph. It can then be easily withdrawn by hand for playing. Replacing a record into its own rack is quite simple. Adjacent to the centre operating board and on each side of it will be seen a vertical white stripe. These have numbers printed on them, one for each rack. The record is "offered" edgeways to its own number on the strip and can then be passed sideways into its own rack, being pushed home until it disappears. Using gramophone records is now really a pleasure; it is not quite certain which is the greater appeal, the utilitarian value of being able to select and obtain any required record almost instantly—or the novelty in operating the mechanism. It has now been in use long enough to know that the records are kept in perfect condition, and it has been proved many times by trials with strangers that, "any child can operate it at once."

[Our readers will agree that the device is very ingenious. It is yet another instance of the home workshop being applied to producing a result which can be appreciated by every member of the household.—ED., "M.E."]

*Traction Engines not so Well Known

by Ronald H. Clark, A.M.I.Mech.E.

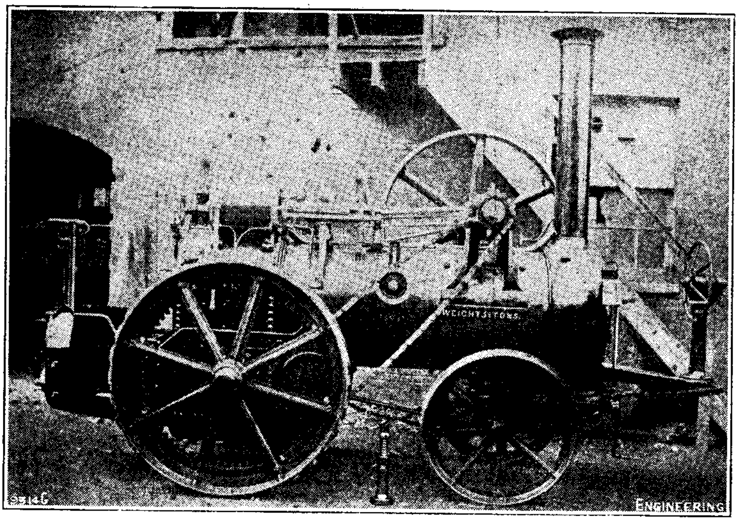


Fig. 14. *Dodman three-shaft traction engine of* 1872

VII—Alfred Dodman & Co. Ltd., Highgate Works, Kings Lynn

Situated in an agricultural district close to the sea, this firm made its first traction engine in 1872, and I include an illustration in Fig. 14, which also shows the interesting form of drive used. As was usual at that period, the cylinder is placed over the firebox, the right-hand end of the crankshaft carrying a 7-tooth sprocket. The second motion-shaft, on which was the differential, was placed just ahead of the firebox and beneath the barrel; on each end of this shaft was a 13-tooth pinion engaging with a large, annular, toothed ring bolted to the inside angle-rims of the rear wheels. Chain tension was adjusted by the jockey pulley on a stub shaft located in a slotted bracket on the side of the boiler barrel, clearly seen in Fig. 14. The front axle was placed well aft of the smokebox, enabling the engine to negotiate gateways more easily, and steering was by handwheel and vertical shaft with side chains attached to the axle, the steersman standing in front of the smokebox door on his platform. At the rear was the manstand with a decorated handrail part of the way round, to which was fixed a large toolbox. Working pressure was 100 p.s.i., and the cylinder was approximately 8 in. × 10 in.

As was only to be expected, the final pinions and annular ring drive was most liable to become clogged with dirt and stones in foul weather, and, therefore ,an improved engine was brought out in 1882; this is shown in Fig. 15. The position of the cylinder has now become standardised at the smokebox end of the boiler, and the drive is by gears and pinions throughout, four shafts being employed. A differential was incorporated on the third shaft, and again the pinion and annular toothed ring are used, the

**Continued from page* 24, "*M.E.*," *July* 7, 1949.

TABLE III—Main Dimensions of DAVEY, PAXMAN Traction Engines

N.H.P.	R.P.M.	B.H.P.	Cylinder	W.P. p.s.i.	Flywheel Dia.	Rear Wheels Dia. × Width	Speeds m.p.h.	Weight Empty
5	180	20	8″×10″	160	3′-6″	5′-6″×1′-2″	2 & 4	$7\frac{3}{4}$T
6	155	24	8″×12″	160	4′-6″	6′-0″×1′-4″	2 & 4	$9\frac{1}{4}$T
7	155	28	$8\frac{1}{2}$″×12″	160	4′-6″	6′-0″×1′-5″	2 & 4	$9\frac{3}{4}$T
8	155	32	9″×12″	160	4′-6″	6′-6″×1′-6″	2 & 4	$10\frac{3}{4}$T
10	155	40	10″×12″	160	4′-6″	6′-6″×1′-6″	2 & 4	$11\frac{1}{4}$T

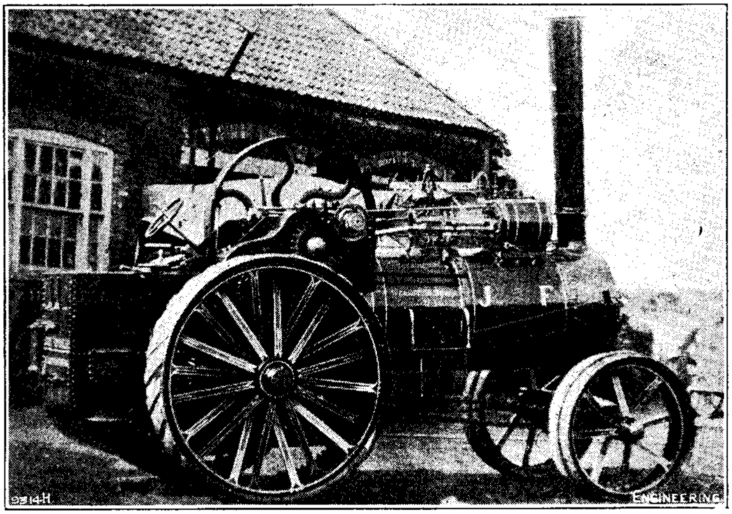


Fig. 15. *Dodman's improved four-shaft engine of* 1882

pinion being this time well up away from mud and dirt. The tender is now higher and deeper and the general finish of the machine is of a very high order. Several of these engines were at work some years after the first war.

The latest type is seen in Fig. 16, again employing the four-shaft layout, the final drive gear being enclosed in sheet-iron covers now standard practice by all makers. The engine seen in Fig. 16 was built in 1911, and it is pleasing to note that the original firebox was still in use in 1942. The cylinder is steam-jacketed, the jacket space being made large enough to form a dome for producing dry steam. It has two speeds, the key splines on the crank-shaft being cut from the solid. All links are of best Lowmoor iron deeply casehardened and ground finished. A differential is mounted on the countershaft and can be locked from the footplate whilst the rear axle could be spring-mounted if desired. All gears are of cast steel, w.p. 150 p.s.i.

They were made in 6, 7, 8 and 10 n.h.p. sizes, and it is interesting for the sake of comparison, to note that the pre first war price of a 10 n.h.p. engine was £595. Among the fittings were included a whistle and a rear lamp with " sliding shutters."

The leading dimensions of the 7 n.h.p.

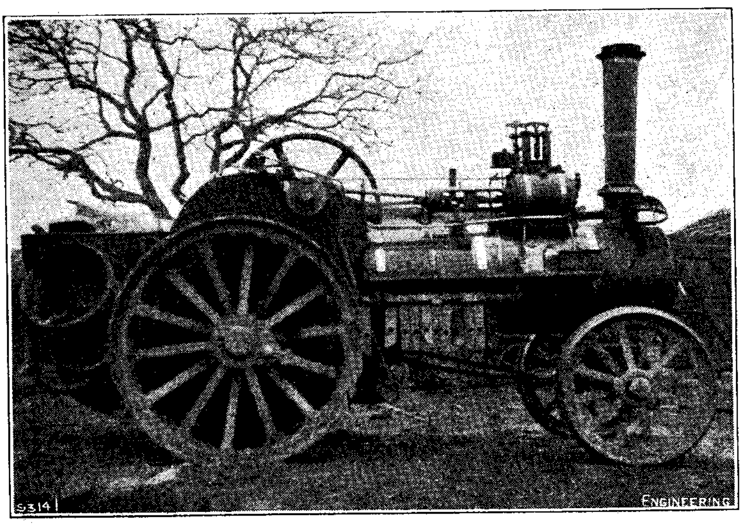


Fig. 16. *Latest type Dodman traction engine with enclosed gear drive*

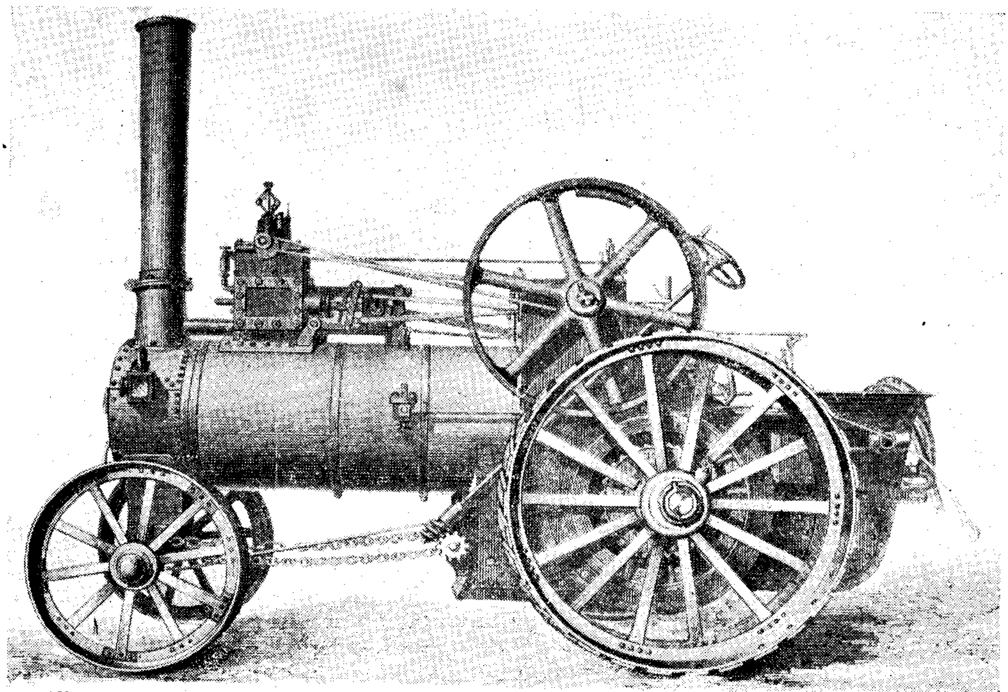


Fig. 17. Standard traction engine by the Durham and North Yorkshire Steam Cultivating Co.

engine depicted in Fig. 16 are as follows: N.h.p., 7. B.h.p., 30. Cylinder, $8\frac{1}{2}$ in. × 12 in. Flywheel, 4 ft. 6 in. diameter. R.p.m., 155 governed. Rear wheels, 5 ft. $11\frac{1}{2}$ in. diameter × 16 in. wide. Overall length 16 ft. 9 in. Overall width, 7 ft. 4 in. Height to top of flywheel, 8 ft. 10 in. Speeds, 2 and 4 m.p.h.

Quite a number of Dodman tractions are yet in use in eastern England and the Fens.

VIII—Durham and North Yorkshire Steam Cultivating Co., North Bridge Engine Works, Ripon

Another small agricultural machinery firm who launched out and made a few self-moving engines between 1878 and 1885. In Fig. 17 is depicted their most successful machine, which had a single cylinder $8\frac{1}{4}$ in. × 10 in., steam-jacketed, the rating being 6 n.h.p., and

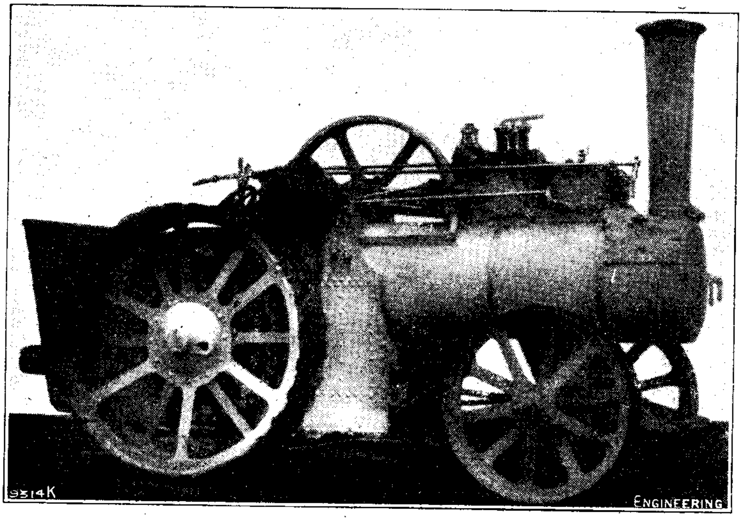


Fig. 18. Eddington & Steevenson's convertible traction engine

was of straightforward design save for two side-plates formed with holes to receive all three shafts, the steerage worm-shaft and the two side mud-holes. They were bolted to suitable angles, planed and riveted to the firebox casing plates and braced across the top by four corner angles so that the resulting frame, as it were, was a rigid box. All driving stresses were, therefore, taken by this box, thereby easing the stresses on the firebox itself. There was thus less likelihood of steam leakage at the firebox riveted seams, and there was the added attraction that these extra side-plates could be easily unbolted at any time.

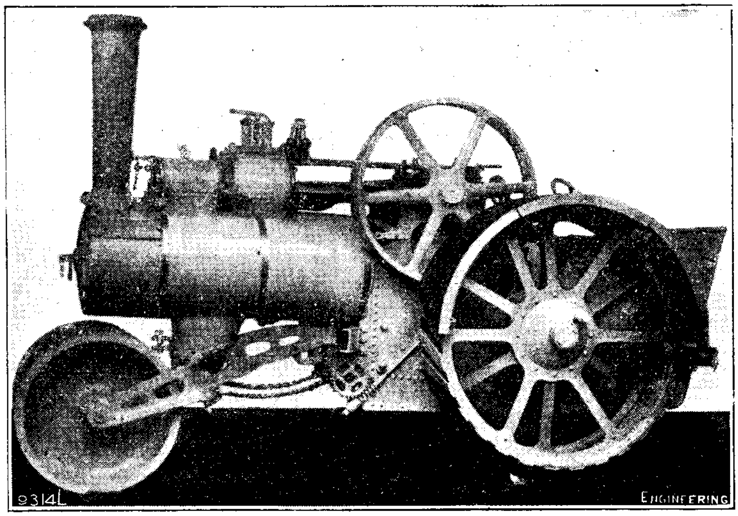


Fig. 19. *Eddington & Steevenson's engine as a road roller*

The crankshaft was 3¼ in. diameter, countershaft 3¾ in. diameter, and the back axle 4¾ in. diameter, fitted with differential gear and Burrell's patent winding drum. Rear wheels were 5 ft. 6 in. diameter × 16 in. tread, front 3 ft. 6 in. diameter × 10 in. tread and two speeds were provided for in the gearing on the offside giving 1½ and 3 m.p.h. When working on the belt the normal speed was 150 r.p.m.

In 1881, the makers produced a freak engine in which all wheels were of the same diameter, the front being coupled to the rear by an endless chain thus effecting an early example of four-wheel drive. It is doubtful if more than one example of this was ever made, although several of the orthodox type were turned out, and there may be one left somewhere in a Yorkshire dale, rusting away.

IX—Eddington & Steevenson Ltd., New Street Ironworks, Chelmsford

Several types of road engine were produced by this firm in their small works, the most interesting being their convertible engine illustrated in Fig. 18 which shows it in the tandem single-crank compound form, a single-cylinder machine being made as an alternative.

Many distinctive features were claimed for these engines by the makers, the list being an extensive one as follows :

1. They could pull 20 tons up a steep hill.
2. Had the ability to pull themselves out of bad places.
3. Final drive spur-ring having incorporated in it a spring cush drive which eliminated driving shocks and road shocks also, as it enabled the rear axle to have a rise and fall over a range of 3 in.
4. Smokebox left clear when the engine was used as a roller.
5. Rollers all track when on curves.
6. Traction wheels can be shod with cast-iron segments as seen in Fig. 19 when converted to a roller, or complete separate rolls used if desired.
7. Wheels (or rolls) cut out of solid steel plate.
8. Front rolls up to 4 ft. diameter.

Whether all these items came up to expectations in practice I cannot say, but item 4 certainly is an advantage when tubes have to be cleaned. Item 6 saves the necessity of changing the rear wheels for rolls when conversions have to be carried out fairly frequently. Cutting out the wheels from the solid plate must have been a costly procedure, ensuring a goodly scrap-heap, although one or two makers employed the method.

Fig. 19 shows the engine converted to its road roller form by attaching the roller frame which carries the pivot of the fore-carriage of the engine, the ordinary steerage chains being connected to this frame, one on either side. This frame is carried back towards the firebox, and beneath the boiler barrel, a suitable channel guide is riveted on to the firebox and in this guide the rear end of the frame works. To convert, one had only to remove the traction engine front axle and then substitute the roller attachment, fit the cast-iron segments to the rear wheels (item 6), when the conversion was complete.

The tandem compound cylinders were 6 in. and 10½ in. × 10 in. and the valve-gear comprised tappet valves operated by cams on a rotating camshaft gear driven from the crankshaft. The precise position of these cams and the consequent lift of the valves were controlled by the high-speed governor.

All the change-speed gears were between the hornplates and gave road speeds of 1¼, 2¾ and 4 m.p.h. The overall width of the traction engine was only 5 ft. 11 in. The weight was 5 tons empty and the engine was rated at 8 n.h.p.

Altogether an interesting and unconventional design which, like so many departures from standard, only sold in very small numbers.

(*To be continued*)

From Models to Mass Production

by

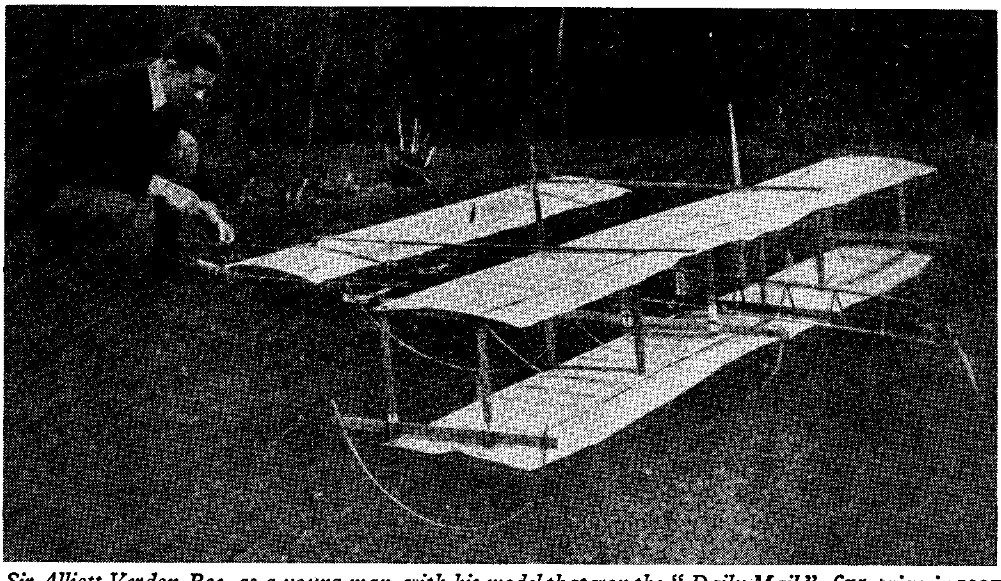
Donald Stevenson, A.F.R.Ae.S.

Sir Alliott with a model of one of the many machines designed by him. Note the gun turrets on the leading edge. Photograph taken October, 1948

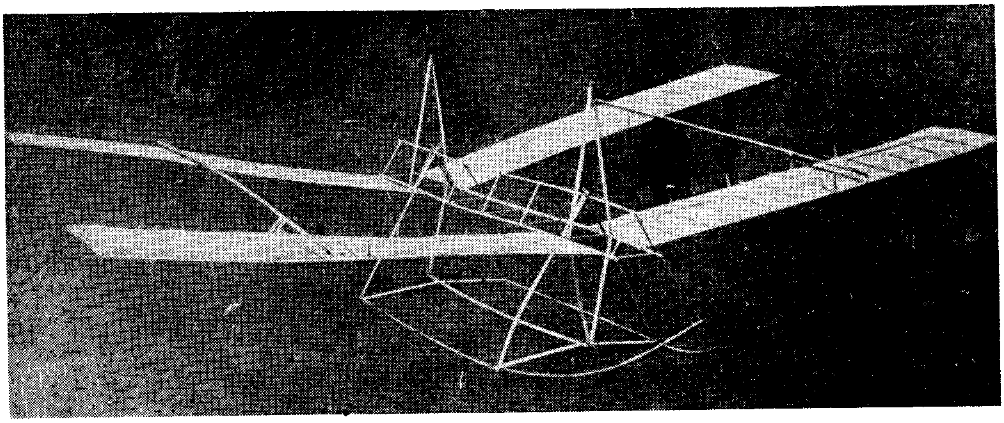
SIR ALLIOTT VERDON - ROE, K.T., F.R.Ae.S., M.I.Ae.S., who, with his brother, founded the great aircraft firm of A. V. Roe Ltd., is known all over the world as one of the real pioneers of flying. He was the first man to design, make and fly a power-driven machine in this country, forty-one years ago this year.

It is interesting to note that he started by making model gliders and then model aeroplanes, which flew successfully. As far back as 1906 he wrote a letter to *The Times Engineering Supplement* giving particulars of the results of his experiments, and pointed out that if models could be made to fly, without anybody on board to control them, it should be possible to make man-lifting machines that would fly. The editor published this letter on January 24th, 1906, but added a note to say that they disagreed with the views expressed and were of the opinion that all attempts at artificial aviation, on the lines indicated, were not only dangerous to human life but foredoomed to failure. Such was the discouragement this young inventor had to face in those days, but he stuck manfully to his ideas through many trials, until at last he won his reward and world-wide fame.

His first outstanding success was in 1907 when he showed some of his model aeroplanes, " Avroplanes " he called them, at an Aero Club



Sir Alliott Verdon-Roe, as a young man, with his model that won the " Daily Mail " £75 prize in 1907

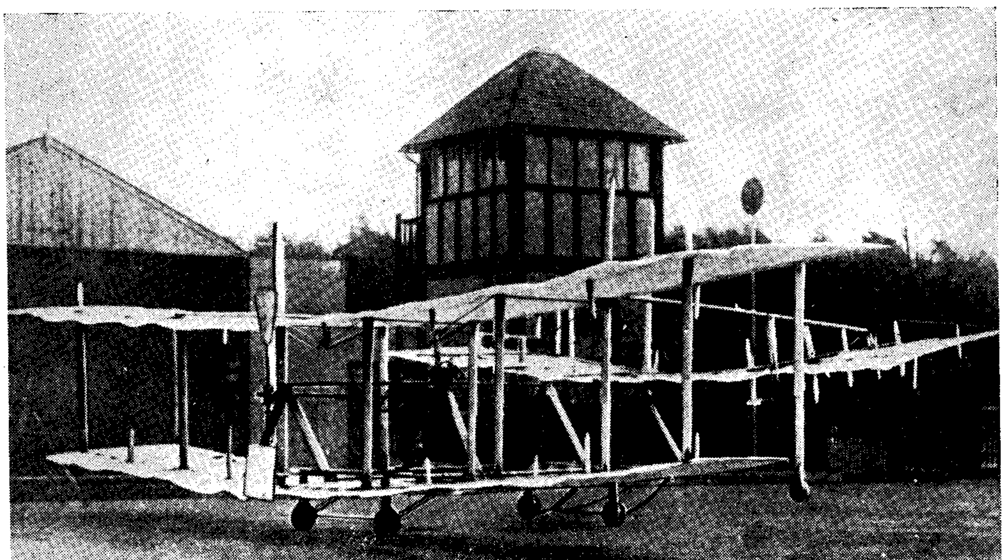


Langley type model aeroplane made by Sir Alliott Verdon-Roe

exhibition held at the Royal Agricultural Hall, London, in April of that year. There were some two hundred entrants. Afterwards he took part in a flying competition at the Alexandra Palace, where the models were moved to be tested.

A large number of competitors took part, and many of the machines were weird and wonderful contraptions. The *Daily Mail* offered three prizes, the first £150, the second £75 and the third £50. None of the models were considered to have fulfilled all the conditions satisfactorily so the first prize was not awarded, but Mr. A. V. Roe (as he was then) was given the second prize for the best performance. The writer was present at the competition and has never been able to understand why this model was not awarded the first prize, because it definitely flew the distances required, both indoors and out of doors, and for design and workmanship it was outstanding. It was the most practical machine in the competition and, like other models made by Sir Alliott in the early experimental days of flying, embodied ideas that have since become accepted principles in aeronautics. Perhaps the judges understood balloons better than model aeroplanes.

A copy of *Ballooning and Aeronautics*, in the writer's possession, Vol. 1, No. 4, dated April, 1907, contains a description of these models, and photographs one of them showing Sir

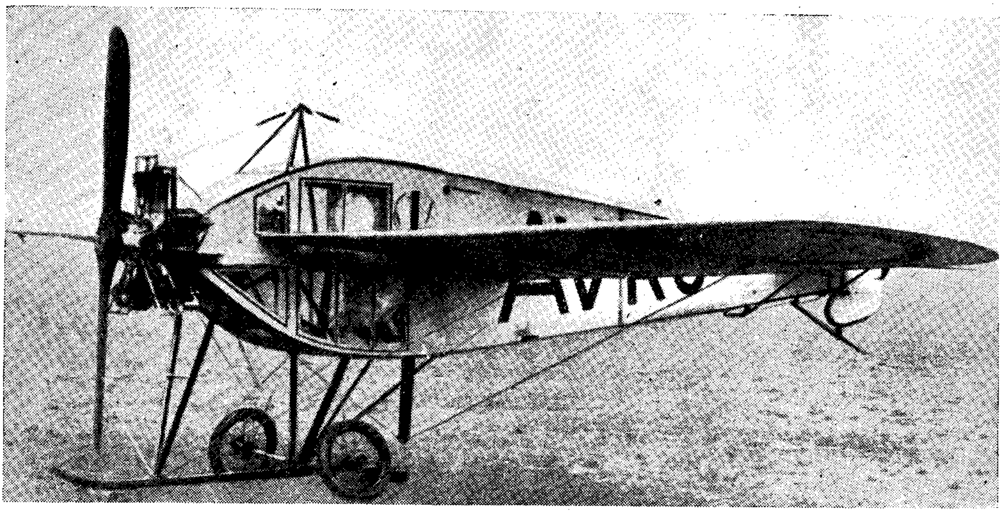


Sir Alliott Verdon-Roe's first full-size power-driven aeroplane, the first to be designed, constructed and flown in Great Britain

Alliott Verdon-Roe, when thirty years old, flying one of the models.

The winning model was a biplane of, what is known today as, the "tail-first" type. The main planes measured 8 ft. 6 in. from tip to tip by 15 in., and it had a forward controlling plane 7 ft. 8 in. by 14 in. The rubber-driven propeller at the back was 22 in., and the whole machine weighed 6 lb.

He first tried it out with a 9 h.p. J.A.P. engine, but this had not got sufficient power to get the machine off the ground. Through having to wait a considerable time for a 24 h.p. Antoinette engine, it was not until June 8th, 1908, that his aeroplane made its first short flights of 70 to 150 ft., about two or three feet above the ground. These were actually the first controlled flights in this country by an English power-driven machine,



The first cabin aeroplane in the world, designed by Sir Alliott and flown in 1912

but the official first flight did not take place until about a year later.

His second model was of a similar type. The span of the main planes was 7 ft. 6 in. and the chord 12 in. The forward plane measured 7 ft. by 1 ft. and the propeller was 20 in. The weight of this model was 5 lb.

The third model was different as, instead of the forward controlling plane, it had two tail planes. These were supported on booms extending out from the rear of the top main plane, one at each tip. The propeller was also at the back of the main planes and the rubber to drive it was held in a triangular framework which extended out in front. It had a 9 ft. span by 15 in. chord, a 24-in. propeller, and weighed $6\frac{1}{2}$ lb.

He also exhibited two other models, a small "tail-first" biplane with 4 ft. span, 12-in. propeller, weighing 2 lb., and a different kind of model of the Langley type embodying his own ideas. This model measured 10 ft. 6 in. from tip to tip, had a 26-in. propeller and weighed $6\frac{3}{4}$ lb.

Having faith in his design, he next decided to make a full-size machine on the lines of his winning model. It is interesting to note that although he still could not get anybody to take his ideas seriously or provide financial assistance, the Government at that time was willing to subsidise the experiments of Cody, the American. Our pioneer had to start to build his machine in a stable and fetch the wood required from the timber yard on his bicycle. In spite of this lack of support and all the difficulties he had to overcome, however, his machine left the ground and flew successfully before Cody's machine.

After that, Sir Alliott designed a smaller and neater machine, a kind of tandem triplane with a tractor airscrew. The main planes were 20 ft. span with 3 ft. chord, and it flew with the 9 h.p. J.A.P. engine. From that time he progressed, though he was not free from the setbacks, worries and trials experienced by all pioneers, but his unbounded enthusiasm and perseverance, and his tireless energy overcame all obstacles and carried him on from success to success.

Sir Alliott Verdon-Roe originally served his apprenticeship as a locomotive engineer, but wanted to go to sea and to travel. He therefore studied for the Navy; unfortunately, however, he failed to pass the exams. Still determined to go to sea, he became a marine engineer, and it was then that he first became interested in the possibilities of flying. During his off-duty time on board ship, he would stand on deck watching the effortless flight of the albatross with motionless wings, until he became convinced that it would be possible to make a machine that would fly.

He made paper gliders and models, on the lines of the albatross, and met with a considerable amount of chaff from his shipmates. This did not deter him, however, nor did the scoffing remarks he had to face when he gave up his job at sea and devoted all the time he could to aeronautical experimental work.

Doing this called for not only great deter-

mination, at a time when anybody interested in flying was looked upon as a fanatic or mild form of lunatic, but also exceptional courage. It must not be forgotten that the pioneers of those days had not only to design and make their machines but *had to teach themselves how to fly them.*

Very little data was available and a great deal had to be found out by trial and error, so it was impossible to tell beforehand what a machine would do, or if the controls would work, until it was tried. Sir Alliott had many crashes during those early days of flying, but even these did not make him give up. Eventually his ideas were perfected and during the Great War huge factories turned out thousands of his machines, and today the name of Avro is known all over the world.

He is still interested in models and has a small workshop at his home, but he does not confine his researches to aviation. His inventions cover a wide range from water taps to special rivets, and from motor-cars to smokeless chimneys. He has that peculiar faculty of seeing ahead possessed by so many model makers. He showed the writer some models of a most ingenious tap, in which the washer can be renewed without having to cut the water off at the main. The act of unscrewing the body of the tap shuts off the water, so that the old washer can be replaced in comfort, and screwing the tap together turns the water on again. It is so simple that one wonders it has not been thought of before. Thousands of these taps are sold weekly now.

His model of the car of the future won a prize in the competition organised by the Society of Motor Manufactures and Traders, in conjunction with their Jubilee Exhibition in 1947. He used his knowledge as an aircraft designer in connection with the streamlining. The car embodies a new system of anti-dazzle, whereby the headlamps floodlight the road sides when cars approach each other. The side-lights shine 45 degrees outwards. Another feature is the bumper all round, there are no projections whatever, push buttons operate the door locks and release the wheel panels, and the number plates do not project, so similar cars could rub together without any damage being done.

Sir Alliott is a good all-round athlete and sportsman, and has a number of cups and medals. He has won some £500 worth of prizes for different sports, particularly cycle racing at which he was well known. A cup he has in his study is one he gained for the long jump at St. Paul's School, when he was fourteen years old.

He frequently acts as a Judge at model aeroplane exhibitions and competitions, and is always ready to do anything he can to help and encourage the young model makers of today. Forty-five years ago, models—forty years ago, one small machine with a 9-h.p. engine—today, thousands of aeroplanes bearing his name including giant air liners over all parts of the earth, and huge flying boats—models to mass production, truly an outstanding example for all model engineers.

PRACTICAL LETTERS

Tool Test Reports

DEAR SIR,—In reference to your remarks *re* trade reports in your issue of June 2nd, I should like to see a return of the trade reviews of new tools (machine and hand) which are of use in the home workshop or the small repair shop.

I consider that lathes up to 5 in. or 5½ in. centres are of home workshop capacity and should be reviewed in this feature, shapers up to 8 in. stroke, small vertical and horizontal millers, etc., regardless of prices, as these are useful in some form or other to the amateur, or professional engineer, who is in business in a small way on his own.

Our journal is read by a large number of personnel and executives in the engineering industry.

I suggest that this feature could be in the form of a monthly page.

Thanking you for many hours of enjoyable leisure.

Yours faithfully,

Coventry. E. OLDFIELD.

Attendance at Regattas

DEAR SIR,—With reference to Mr. F. H. Gray's comments on the S.E. Association regatta, I would like to point out that the actual number of competitors with boats who attended the regatta was more than the number stated in his letter.

The fact that some of the racing boats failed actually to run was unfortunate, but the owners should be given due credit for their attendance. I was present at the regatta, and in the racing classes the following competitors had boats in the enclosure.

Class "A." Messrs Parris and Lynam (S. London), Meageen (Altrincham), Ward (Orpington).

Class "B." Messrs. Lines and Cluse (Orpington), Jutton (Guildford), Benson (Blackheath).

Class "C" (Restricted). Messrs. Phillips and Stone (S. London), Walton and Hancock (Kingsmear).

There were also sixteen steering boats present (one of which withdrew due to mechanical failure), so I do not think that this regatta could in any way be called unsuccessful, and it does not follow that masses of boats are an essential part of a successful regatta; in fact, too many boats may give the officials in charge a heavy task.

A factor which influences the attendance of regattas and other model engineering functions is the present high cost of rail travel combined with petrol rationing. Long-distance competitors are unlikely to attend many of the regattas, etc., held during the year, preferring to support those events which are nearest their homes.

In conclusion, I would like to thank Mr. Gray for his interest, and cordially invite him to have a crack at making a model power boat, so setting a good example to the laggards!

Yours faithfully,

Catford. JOHN H. BENSON.